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OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

MARCH 20, 1950
VOLUME 39, NO. 6

AMERICAN DYESTUFF REPORTER

DEVOTED TO TEXTILE CHEMISTRY • BLEACHING • DYEING • PRINTING • FINISHING

Put it in print with VAT COLORS

Du Pont vat color pastes for printing cottons and rayons—PONSOL* and LEUCOSOL* colors (anthraquinone-type dyes)... SULFANTHRENE* colors (thioindigoid-type dyes).

The physical properties of these products are especially controlled to yield a full range of shades in printing. They offer the best all-round fastness obtainable... help assure customer satisfaction. E. I. du Pont de Nemours & Co. (Inc.), Dyestuffs Div., Wilmington 98, Del.

*Reg. U. S. Pat. Off.

Du Pont Dyestuffs

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BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

MACHINES THAT THINK FOR YOU...

IN TERMS OF GREATER PROFIT!

Automatically—with the barest minimum of skilled help—Gaston County's Combination Beam and Package Dyeing Machines take wasteful guesswork out of dyeing.

You get surer quality, *more economically,* with Gaston County's modern control features: automatic temperature controls—automatic dye liquor flow reversing mechanisms—patented two-way running wash system—and dye liquor flow controls. The new Robot DYEMASTER gives you permanent records for matching colors quickly and perfectly.

You can dye beams, cones, roving, springs, tubes, and cheeses *all* in the Combination Beam and Package Dyeing Machines with a simple change of carriers.

Let us supply the machine that *exactly* fills your requirements. We build extractors, dryers . . . package, raw stock, and sample dyeing machines . . . single or multiple-kier set-ups, ranging from 1 to 2,000 pound units, all built with Gaston County's money-saving automatic controls.

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PIONEERS IN AUTOMATICALLY CONTROLLED DYEING MACHINES

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Gaston County Dyeing Machine Co.
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614 St. James St., W. Montreal
137 Wellington St., W. Toronto

American Dyestuff Reporter, Vol. 39, No. 6, March 20, 1950. Published every other Monday. Copyright 1950, by Howes Publishing Co., Inc., One Madison Ave., New York 10, N. Y. Domestic subscription, $5.00; Canadian, $6.00. Foreign, $10.00. Entered as second-class matter, Nov. 6, 1919, at the New York, N. Y., Post Office, under the act of March 3, 1879.

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Product of
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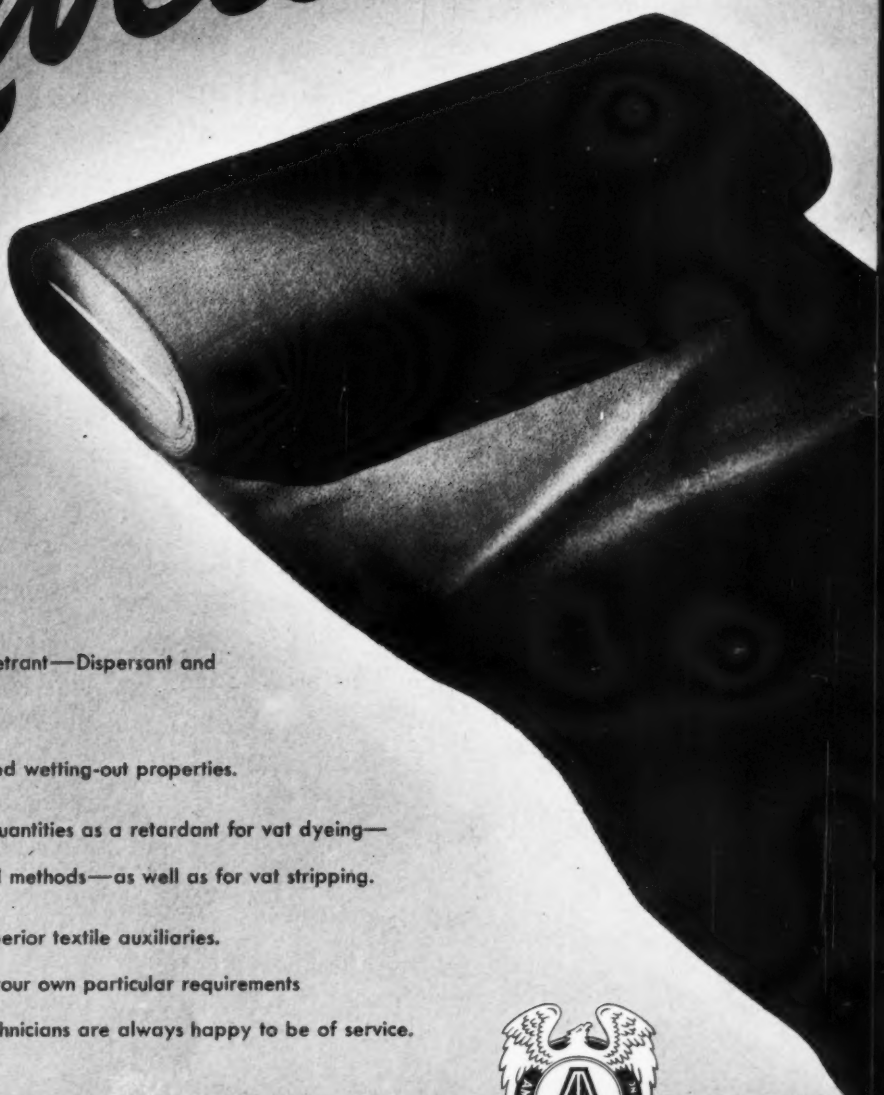
NEWLY IMPROVED!!!
now a *four star* product

Levelene*



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★ finishing

An effective Leveling agent—Penetrant—Dispersant and active Stripping Catalyzer.

New Levelene has greatly improved wetting-out properties.

Particularly well suited in minute quantities as a retardant for vat dyeing—either in the pigment pad or reduced methods—as well as for vat stripping.

Another of the A.A.P. range of superior textile auxiliaries.

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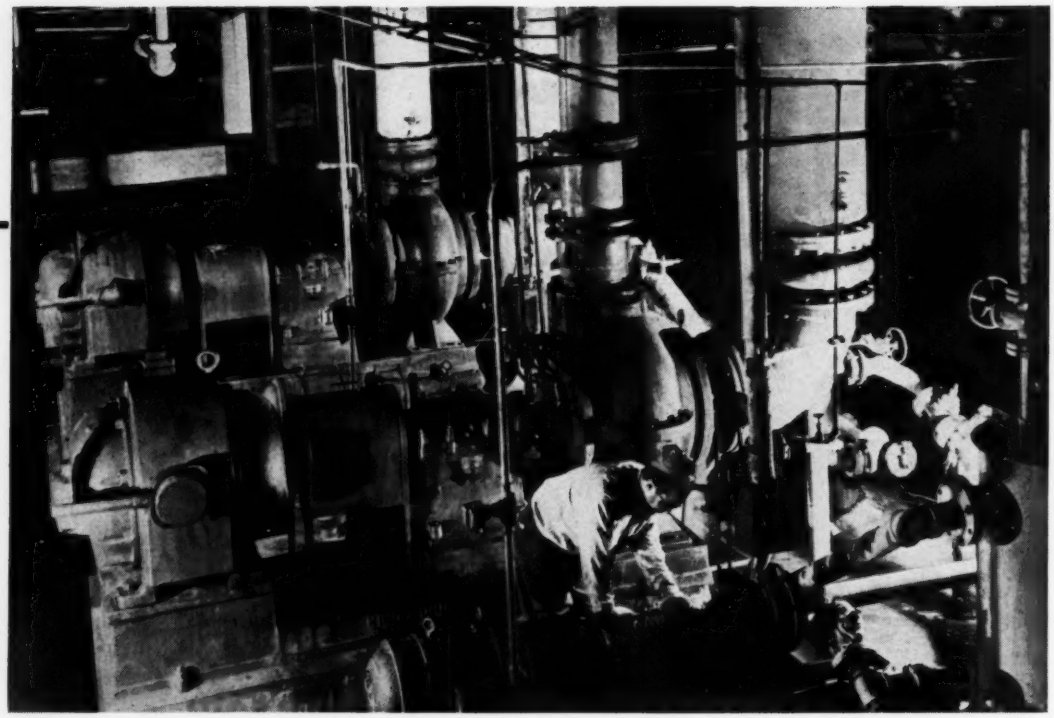

For the Quality you want
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IF YOU find it necessary to clean your caustic storage tanks frequently because of sludge deposits, it's time to try Hooker Caustic Soda. Thanks to a recently improved purification process, Hooker Caustic Soda is remarkably free from those impurities that leave sludge deposits. Low in iron and sulfates, it is a high purity product—a purity that is uniform in shipment after shipment.

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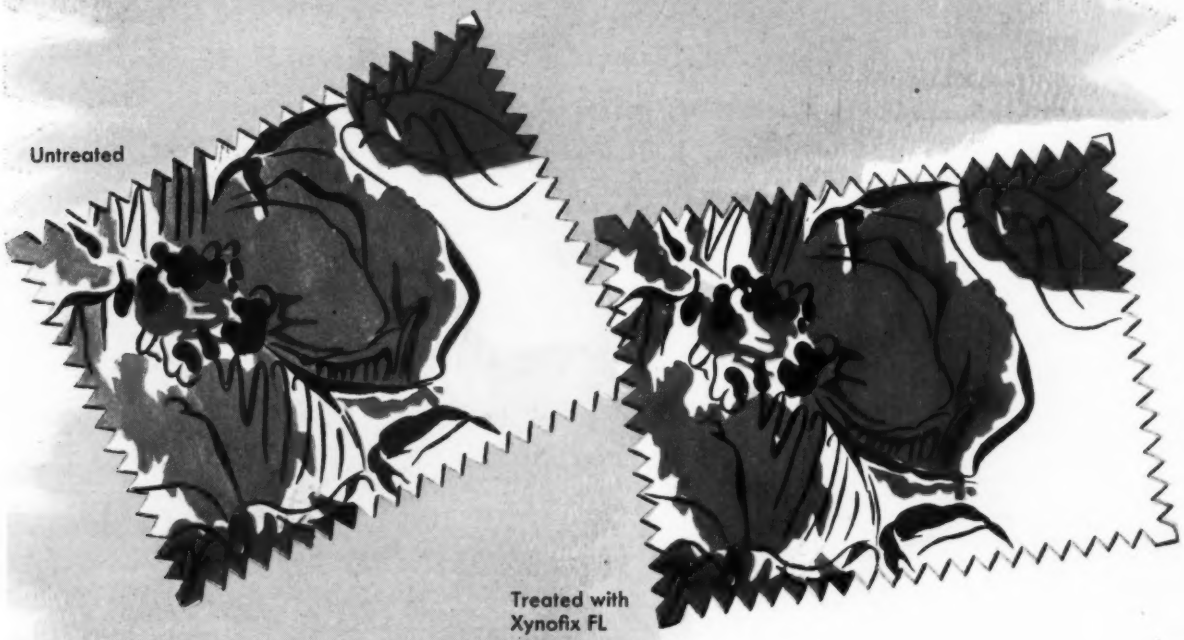
No More Bleeding on Your Prints



...when you use XYNOFIX FL

XYNOFIX FL in the last print wash will eliminate bleeding—even on colors that usually give you plenty of trouble.

Xynofix FL is also your insurance against streaky goods caused by drying delays.

It's easy to give Xynofix FL a test run. Ask us for details.

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TEXTILE DIVISION
JERSEY CITY 2, N. J.
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In Canada: Onyx Oil & Chemical Co., Ltd., Montreal, Toronto, St. Johns, Que. For Export: Onyx International, Jersey City 2, N. J.

Today's architects and builders have the means to protect their creations from electricity on the rampage . . .

. . . and today's WORSTED manufacturers have the means to protect the quality of their products from mischievous electricity—STATIC that plays havoc with desirable yarn production. For Nopco's new, specifically developed lubricant —NOPCO* 1656-R—provides an anti-static oil that assures better WORSTED production.

Fibres treated with Nopco 1656-R remain static free throughout carding, gilling, combing and drawing—in spite of today's speeded up processes. Result: "Wild" and broken ends are avoided, and even-running yarn is assured.

Nopco 1656-R successfully replaces any conventional lubricant you are now using. It is applied in the same manner . . . no changes in equipment or methods are needed. Whatever your production system—American, Bradford or French—this remarkable new oil can be used with great advantage to produce HIGH QUALITY WORSTED YARNS economically.

Ask your Nopco representative for full information about 1656-R — or write to us directly.

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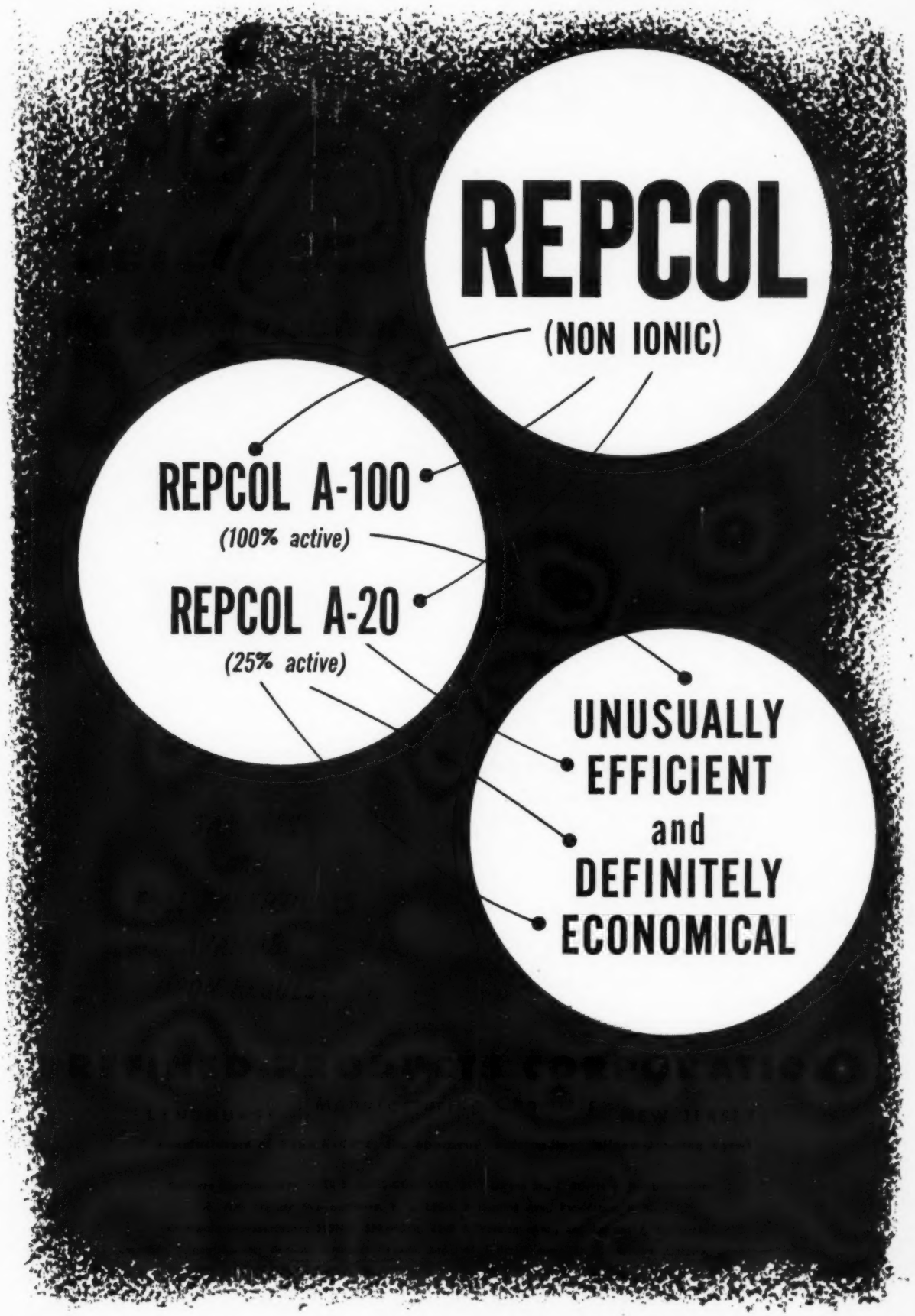
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(NON IONIC)
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UNUSUALLY
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DEFINITELY
ECONOMICAL

BETTER TEXTILE PROCESSING

A Digest of Late Developments in

Issued By
THE ATLANTIC CHEMICAL COMPANY, INC.,

Atco's New Laboratory Facilities

Recently completed, ATCO'S new textile chemical research laboratory is now fully manned and in daily operation. The new lab is concentrating on new product development and analytical work. ATCO'S product control laboratory has been expanded 200% to include laboratory space previously devoted to technical service and research.

Also new and just recently in full operation is ATCO'S application and development laboratory. This lab group supplies technical service to the textile trade and develops and evaluates processing methods for newly marketed chemical compounds.

ATCO's New Research Laboratory

Anti-Static and Fibre Lubricant for Nylon

As you know, many fabrics such as nylon, acetate and wool have high electrical resistivity. These fibres have the tendency to generate a high charge of static electricity when being processed and subjected to friction.

These electrical charges in piece goods and on yarns cause many difficulties. The goods have a tendency to attract lint and dust. The worker is troubled by annoying shocks. The goods cling to machinery, boxes and tables, making it very difficult to inspect, cut, and sew garments. The consumer is bothered by the clinging of the garment which in turn affects the draping qualities. ATCO has recently developed an anti-static and softening agent that prevents the development of static electricity. This material, called "Atco Anti-Static N-30", is padded on and dried into the fabric or yarn at concentrations ranging from .5% to 2% by weight.

Water-Repelling Nylon, Acetate and Filament Rayons

It is a fact that smooth non-absorbent fabrics such as nylon, acetate and many filament rayon fabrics can not be made water-repellent with the common wax emulsion types of repellents without marking or chalking when creased or rubbed. This difficulty was partially overcome by water-repelling fabrics in two baths, using soap in the first bath and a metallic salt in the second. A highly water-repellent finish was thus achieved with no marking-off. However, this was an expensive process because of the double padding and drying operations. There was therefore an economic need for a one-bath process that would produce as good or better results as the two-bath method. Slowly the textile chemical industry developed this process but trouble resulting from specking and foaming due to poor and unstable emulsions continued to exist.

ATCO has overcome these difficulties with a two-package repellent that is mixed and applied in one bath. These products are called ATCO-DRI A and ATCO-DRI B. They are mixed by stirring 5% of ATCO-DRI A into a full volume of water at 160°F after which the ATCO-DRI B is stirred in. This solution is padded onto the cloth, dried and silk calendered. The process is now being run very efficiently in many plants with no difficulties from mark-off. The resulting finished fabric is soft and silky and has a very high spray rating.

THROUGH BETTER TEXTILE CHEMICALS

Modern Textile Research and Application

CENTREDALE, RHODE ISLAND

Hinnekens Unit Boiloff

The Hinnekens Unit and other similar modern machines are now being more efficiently used to boil-off synthetic fabrics economically. The Hinnekens machine holds 300 to 400 yards of cloth immersed in an 8000 gallon tank. The cloth is looped slack in 4 foot open loops on rods that have a slight up and down movement which forces the detergent liquor through the fabric. The problem has been to formulate a detergent combination that would stand up for a long period of time under these conditions. ATCO has introduced a scientifically balanced detergent formulation for this process that does this job more economically and efficiently. The ATCO formulation works with high efficiency under all Hinnekens unit conditions and is being successfully used in many of the largest and most reputable finishing plants. The formulation involves the use of ATCOPAL D and ATCOSOL #66 in combination with small amounts of sodium tetra pyro phosphate and Sodium Carbonate.

Printing and Finishing with Highly Stable Wax Emulsions

A wax emulsion that is stable to acids, alkalies, and electrolites has long been sought in textile printing. Waxes incorporated into printing pastes are poorly emulsified by common color-shop methods and there has been a need for a very stable wax emulsion that would stand up in a print paste under printing conditions.

ATCO has developed a product that answers this requirement and it is now being marketed under the name of ATCO-MULSION-P. It has been found to increase color value of vat colors and their resistance to staining when overdyeing the ground. It can be incorporated into caustic resist pastes for seersucker effects and into sulphuric acid resists. It is generally considered a good mechanical resist for naphthols, rapidogens, vats, and soluble vat colors.

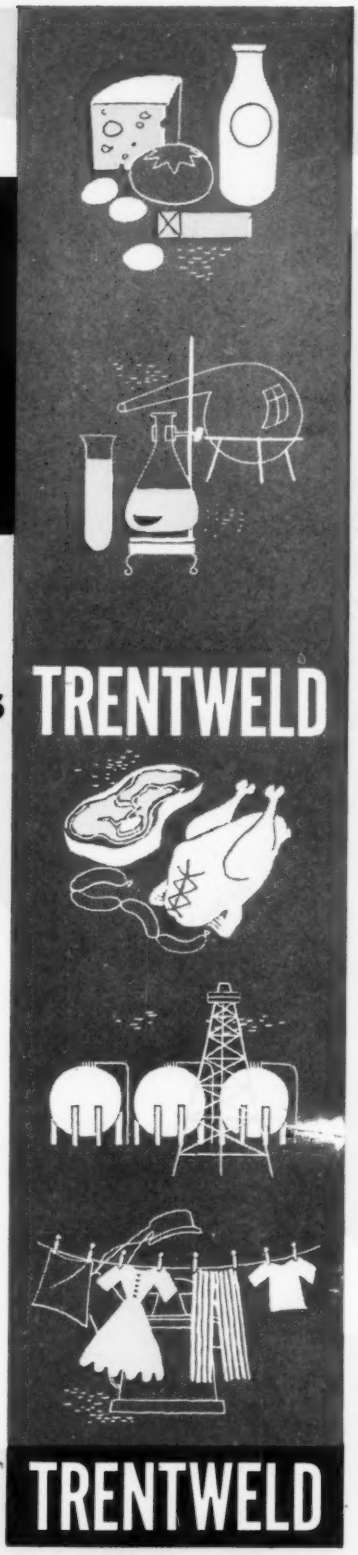
Hinnekens Unit Operation in Leading New England Finishing Plant

ATCO-MULSION-P is also being incorporated into complicated finishing mixtures where other common types of wax emulsions would break down. ATCO-MULSION-P is now being manufactured in large volume and is available to the textile industry.

Wetting Out in Desizing

Proteolytic and amylolytic enzyme solutions used in desizing cotton and rayon have only a very small degree of surface action. Yet, these solutions are required to wet-out non-absorbent greige goods. The result is that in most cases thorough wetting does not take place with the enzyme. Enzyme efficiency is therefore down in proportion to the thoroughness of penetration and fibre wetting.

Care must be taken in the use of wetting agents in enzyme solutions because most of the common wetting agents destroy the enzyme action. ATCO has developed a synthetic wetting agent that can be used in enzyme solutions. This material called "Atcopal D" increases the fibre penetration of the enzyme, providing a more even and complete desizing. Its presence in the fabric after desizing aids in the removal of the converted starches and gelatines in the afterwash. ATCO recommends that "Atcopal D" be used in concentrations from .05% to .1% for wetting in enzyme application.



industry wide...it's TRENTWELD

In processing plants throughout industry where cleanliness, corrosion, heat or abrasion are production problems, more and more engineers and designers are looking to TRENTWELD Stainless Steel Tubing for the answer.

That's because TRENTWELD is made in a *tube* mill by *tube* experts . . . who roll and weld stainless and high alloy tubing *without* added rod metal. Developed by Trent specialists, this method results in tubing that is metallurgically correct and has a uniform section . . . with no zone of weakness for corrosion to attack.

The complete TRENTWELD line . . . 1/8" to 22" diameter in long lengths and up to 30" diameter in shorter lengths . . . offers a wide range in a variety of grades, gauges and finishes for almost every industrial application.

Whatever your industry, there's TRENTWELD Tubing to fit your design. Our years of experience as tube specialists is at your call. Write us full details about your application.

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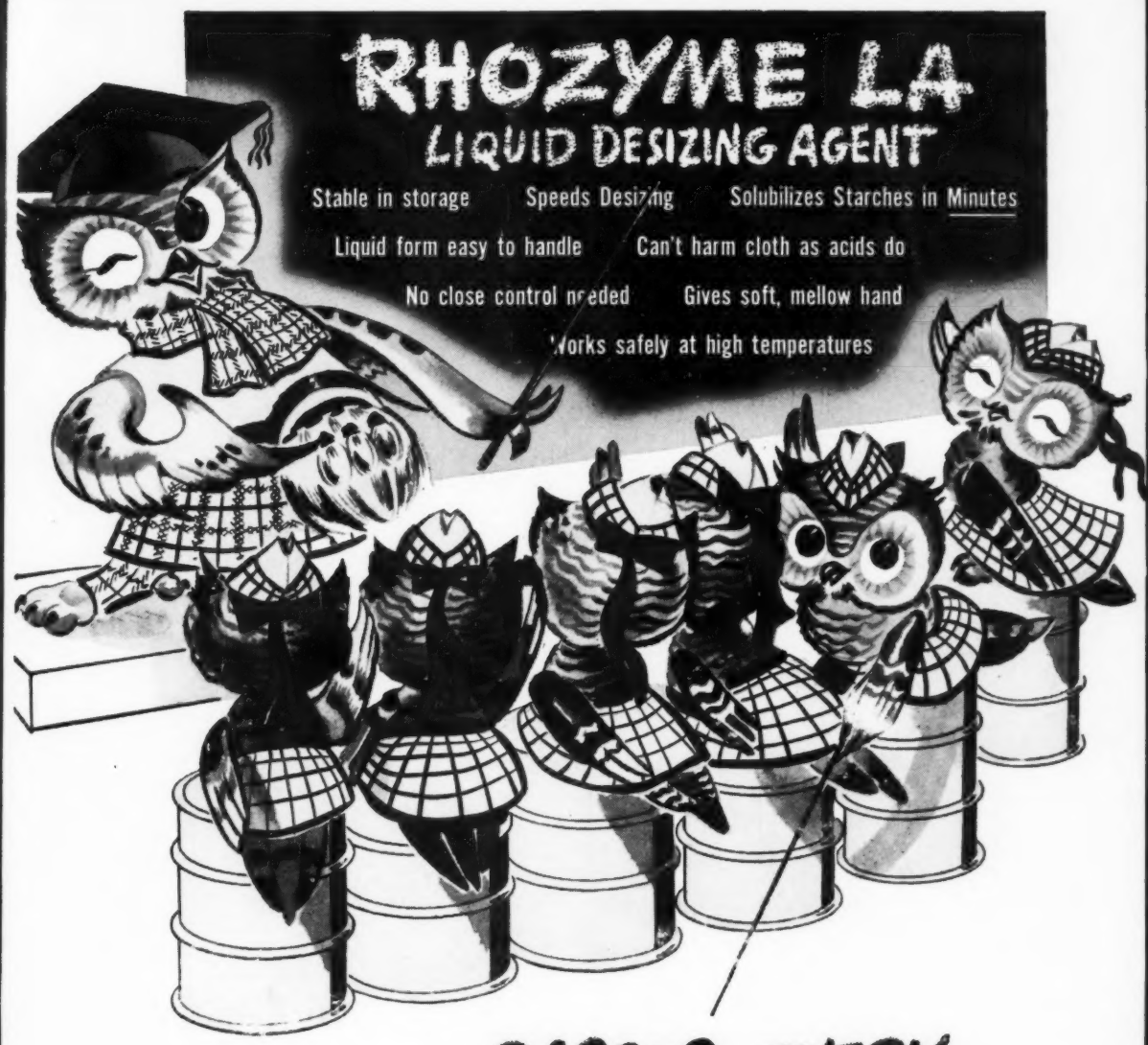
STAINLESS STEEL TUBING



PASSES EVERY DESIZING TEST!

Be wise and thrifty.
Write today for full details of this low-cost, highly efficient new enzyme desizing agent... RHOZYME LA.

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ROHM & HAAS COMPANY

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Representatives in principal foreign countries

RHOZYME *is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.*

Photograph courtesy Celanese Corporation of America. Yarn content: Warp — Celanese acetate rayon dull filament; Filling—Celanese acetate rayon bright staple.

A DURABLE GAS-FADING INHIBITOR

ARIPERM P M

Gives fabrics composed partially or wholly of

Acetate Rayon

— lasting protection against fading from atmospheric gases

— with excellent resistance to *WASHING AND DRY CLEANING*

Recommended for dyeing Light Shades, Pastels & Tints as well as medium and heavy shades.

With Ariperm P M there is no appreciable yellowing effect on white goods when exposed in the gas chamber—relatively little effect on light fastness of the color.

Simple application in scouring or directly in the dye bath.

Write for Technical Service Bulletin #201-121.1

Arkansas Co. INC.

NEWARK, NEW JERSEY

sulphur colors

in sulphur colors,
the first and
foremost brand
names are

KATIGEN
IMMEDIAL
INDOCARBON

PRODUCTS OF THE GENERAL DYESTUFF CORPORATION

if your problem concerns sulphur colors
a consultation with General Dyestuff Corporation
may prove very beneficial

GENERAL DYESTUFF CORPORATION
435 HUDSON STREET, NEW YORK 14, N. Y.

Who Made This Shorty a Success?

This lightweight wool coat was an instant success. That's because the manufacturer realized the importance of graceful draping qualities; of bright, clear colors; of a soft, smooth fabric that refused to wrinkle.

That is where Amalgamated Service comes in. Our chemists work side-by-side with a manufacturer to determine the proper scour, dyeing assistants and softeners to make his fabric sell.

Amalgamated Chemical Corporation Products include Fabric and Hosiery Finishes, Dyeing Assistants and Scouring Agents. Amalgamated Field Representatives are experienced Textile chemists, ready to assist with any textile chemical problem. Our modern, completely equipped research and production laboratories are at your service for better fabrics that sell faster. Write or call Amalgamated.

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Southern Division: 1819 Spring Garden Street, Greensboro, N. C.

Amalgamated

LYOFIX SBK

A CATION ACTIVE FIXING AGENT

To a very marked extent . . . Lyofix SBK improves the wet fastness of direct color dyeings, and direct and acid color prints on viscose rayon and cotton. In particular, Lyofix SBK improves the fastness to water, milling, sizing, finishing, wet pressing, perspiration and sea water. For example . . .

By inhibiting the bleeding of direct and acid color prints into the white ground,

LYOFIX SBK *makes this important difference*

Your inquiry is invited

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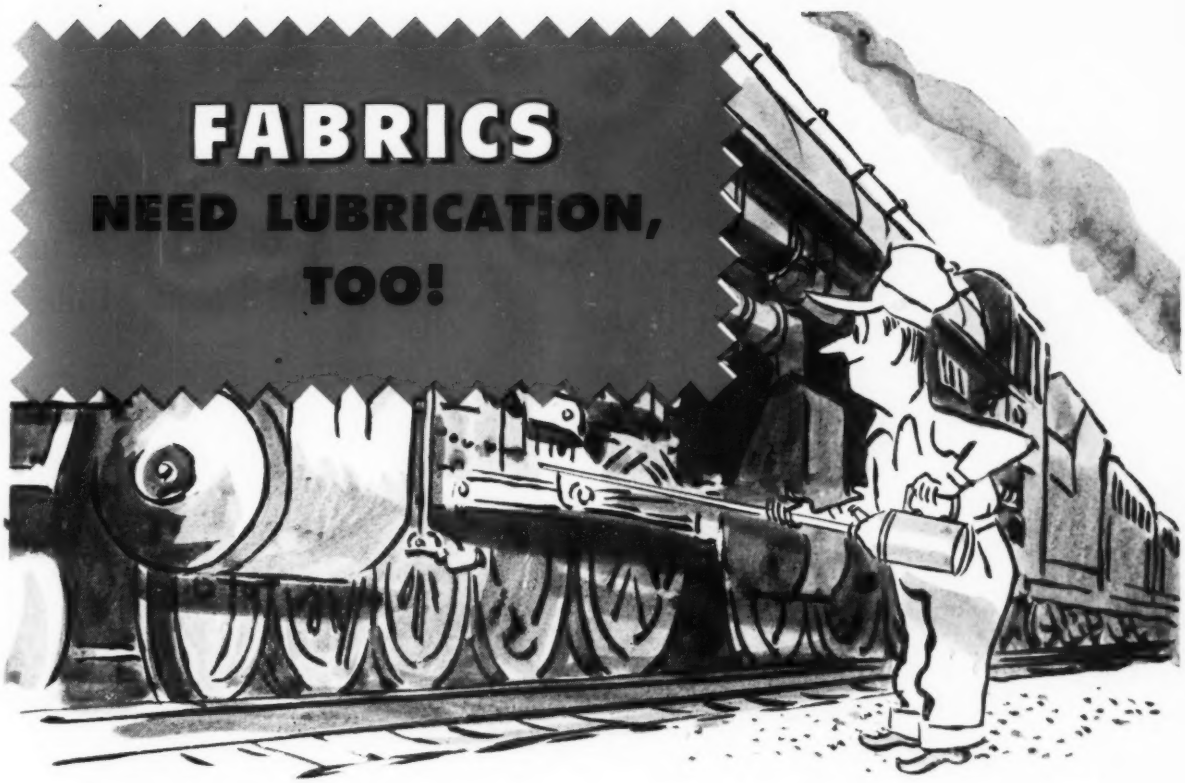

For smoother, softer fabrics, use "Avitone" fiber softener on cottons and synthetics. The use of "Avitone" means improved performance of fabrics during high-speed sewing operations —the needle slides easily between the softened fibers, minimizing cutting or breaking of yarns. Fabrics treated with "Avitone" are easier to work with, too—stay lovely even in storage—and whites *stay* white!

EASY TO USE: "Avitone" is stable to hard water. "Avitone" doesn't turn rancid or discolor on aging—and its wetting action aids shrinking processes.

Look into "Avitone" today. For further information, check with Fine Chemicals Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware. Branch offices: Atlanta, Boston, Charlotte, Chicago, New York, Philadelphia, Providence, San Francisco.

AVITONE
TRADE MARK
Fiber Softener

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Are you getting the MOST from the wool you buy?

You'll cut spinning costs by increasing yarn strength with SYTON

Now, with wool prices climbing, it's more important than ever to *save* when you spin. Ample reason to look into the ways many woolen and worsted mills are cutting costs with Syton.

Syton builds yarn strength from 10%-to-30%. In many mills that means less lap waste and fly, and fewer ends down during spinning and weaving. You know, even better than we, what fewer ends down can mean in production time saved, and expensive labor time saved . . . in *your* mill.

Here are a few of the ways Syton makes operating economies in woolen spinning. Similar savings are made by worsted spinners, carpet makers and commission spinners.

Easier Carding:

Syton means better parallelization of the fibers. Fibers are more uniform and controlled so that cards may be speeded, often with reduced fly and waste.

Stronger Ropings:

Because ropings are stronger, there are fewer ends down at the condenser and at the unwinding of the jackspools.

Faster Spinning:

Syton controls fiber slippage during elongation or draft. This permits faster machine speed. Better fiber control during spinning increases tensile strength and permits twist to be reduced.

Finer Counts:

Finer counts can be spun on all grades of stock, including lower grades which are becoming more and more important as wool prices rise.

Improved Dressing, Weaving, Finishing:

Greater yarn strength helps warp dressing and increases weaving efficiency. The woven fabric fulls more evenly.

THE WALL STREET JOURNAL,
Thursday, January 26, 1950

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Suit o' Clothes

Soaring Wool Prices Kick Costs Upward for Suit and Pants Makers

May Mean Higher Prices on Fine Apparel, Wider Use Of Lower Grade Wools

World Fleece Supplies Fall

Just four months ago a pound of fine Australian fleece could be bought in Boston for $1.40. By early last week it had climbed to $1.85. It's now flirting with the $2 level. A Bostonian who has spent his life studying wool thinks "it could easily go to $2.25."

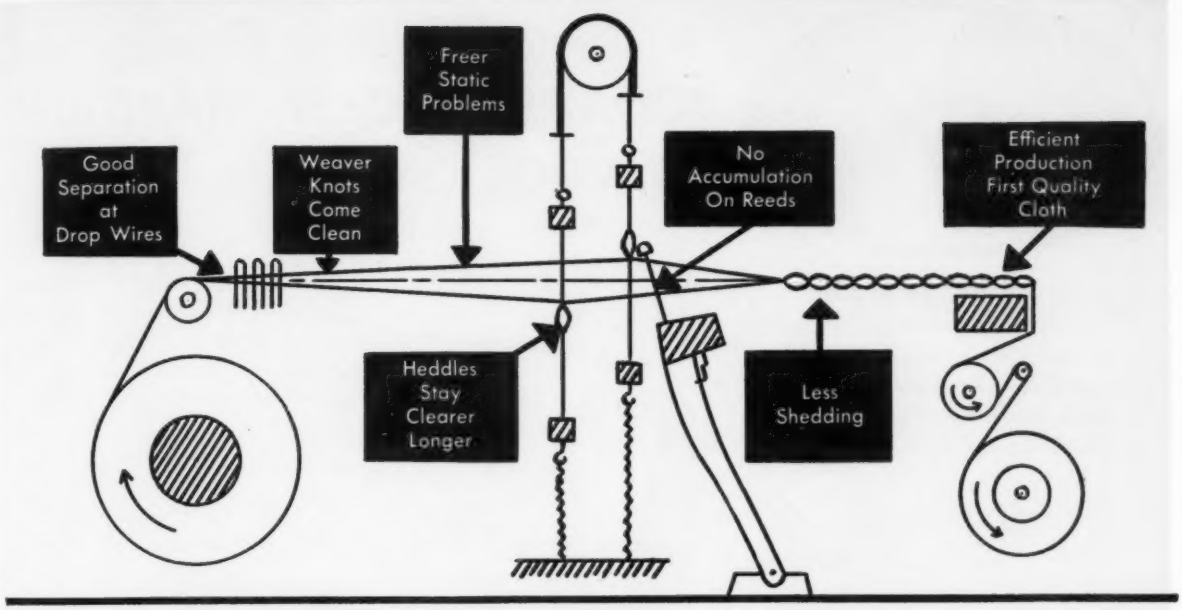
Manufacturers, generally, are afraid to push up prices much; they fear a balky public will trim its clothing purchases. So the switching to a higher percentage of lower grade wool may come pretty heavily into the picture, wool experts believe.

Syton is a silica dispersion created and developed by Monsanto research and successfully put to *work* by the mills. Based on figures of the U. S. Census Bureau, 38.6% of all the woolen and worsteds spun in the United States in 1949 were spun with Syton.

Syton can mean savings in your mill, too. So start saving as soon as you can. We're ready to give you full details on Syton as applied to your mill. Send the handy coupon today.

FREE BOOKLETS, TECHNICAL HELP

Send today for free booklets, or for technical help with Syton right at your own plant. Please use the coupon on the opposite page.



Advantages of Stymer Size

How more and more mills make acetate weaving faster, easier

Many of the largest and best-known mills are ordering and re-ordering Stymer. No better proof that Stymer deliver results, technically and economically. In addition to weaving, Stymer gives you these advantages in slashing: Easily mixed and large mixes can be stored for long period; does not gel when cold and will not clog pipes or valves; no static build-up and a minimum build-up on cans; smooth warps and easy splits at the "bust bars;" allows low-temperature drying; no can covers necessary; no throwaway and no scum in size box; possible elimination of squeeze roll jackets.

Syton, Stymer: Reg. U. S. Pat. Off.

For full information on Stymer,

please send the coupon below.

MONSANTO
CHEMICALS — PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

MONSANTO CHEMICAL COMPANY, Textile Chemicals Dept.,
Desk ADT-30 Everett Station, Boston 49, Mass.

Please send me:

- ☐ General information on Stymer
- ☐ General information on Syton

Syton booklet for: ☐ woolen spinners ☐ worsted spinners ☐ carpet makers ☐ commission spinners

Name _____ Title _____

Company _____

Address _____

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PROCTER & GAMBLE

PROXOL

MADE IN U.S.A.

TODAY'S BIGGEST "BARGAIN" IN WOOL OILS!

A "bargain", says the dictionary, is an advantageous transaction." And plenty of woolen processors can testify that the better results they have had with Proxol thoroughly justify calling Proxol "today's biggest bargain in wool oils."

Procter & Gamble

CINCINNATI, OHIO

Proxol's advantages show up in all of the many processing operations involved in converting raw wool fibers into finished fabrics.

Proxol emulsions are stable. Proxol increases carding and spinning efficiency. It's anti-static and non-corrosive...reduces fly and waste...won't harm aprons. Rovings are uniformly firm and well condensed.

Proxol undergoes no change when it's on your raw wool, yarn or fabric. No matter how long it is stored, Proxol won't heat up or develop odor or discoloration. *And Proxol scours out easily!*

THR-R-R-IFTY! IT'S ALL WOOL N' A YAR-R-R-D WIDE!!

If you're interested in smooth, trouble-free production, it will pay you to try Proxol. You, too, will say it's today's biggest bargain in a truly efficient wool oil.

PROXOL—

made by the makers of Olate,

America's #1 all-purpose textile soap.

Reduces Rayon 'Seconds'

'Hard Size' is minimized by a slower congealing warp size

Try a quick run-off in your mill. You'll find that **SPUNJEL** – a specially prepared warp sizing gum for spun rayon – will not congeal or set-up in the feed line or in the size box during normal operation. It was developed to minimize imperfection rejects caused by 'hard size.'

Photo courtesy of JANTZEN

SPUNJEL can also be worked into your present formula to greatly minimize 'set marks.' Its high adhesiveness and strong, flexible surface film actually increases the tensile strength of the yarn.

National
STARCH PRODUCTS

Address: 270 Madison Ave., New York 16; Boston, Philadelphia, Atlanta, Indianapolis, Chicago, San Francisco and other principal cities. In Canada: National Adhesives (Canada) Ltd., Toronto and Montreal.

We'd like to test these NATIONAL Textile Specialties and Starches:

- ☐ Please send test samples
- ☐ Have a representative call
- ☐ SPUNJEL (described above)
- ☐ AMBERTEX M for screen and machine printing
- ☐ FLOTEX to replace natural printing gums
- ☐ FLOCK ADHESIVE 970 for chenille printing
- ☐ FARILON for Rapidogen printing and backfilling
- ☐ FIBERJEL V for filament viscose sizing
- ☐ CLEARFILM for bright, lustrous finishes on cotton and rayons
- ☐ VAT THICKENER 36 for rayon and cotton

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Company_____

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City_____ Zone_____ State_____

*INDIGOSOL** GOLDEN YELLOW IGK

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MARCH 20, 1950
VOLUME 39 NUMBER 6

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VOLUME 39 MARCH 20, 1950 NUMBER 6

CHEMICAL CHANGES IN WOOL RESULTING FROM WEAR AND DRY CLEANING*

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Introduction

IN the course of use, wool fabrics are subjected to various influences associated with wear, cleaning, and exposure to the environments in which such usage occurs. All of these factors in some manner modify fabrics and the fibers of which they are made. The extent of the influence exerted by these different factors on some of the physical characteristics of three weights of wool serge has been reported at an earlier date *(1)*. That investigation now has been supplemented with additional data concerning changes in some of the chemical properties of the same materials.

The serviceability study mentioned above showed the effects of wear and dry cleaning on the physical properties of new, all-wool, 12-, 14-, and 16-ounce serge when made into men's trousers and put into actual use. These garments were worn by college students during three experimental periods of 1500, 3000, and 4500 hours' duration, respectively, with five dry cleanings for each 1500-hour period. Additional lengths of material, serving as controls, were stored and dry cleaned to parallel the conditions of wear. Both worn and control fabrics were compared with the new materials to obtain evidence of the effects of wear and/or dry cleaning.

Changes in some of the chemical properties of the same fabrics, subjected to the same treatment, during the same experimental periods, also have been studied. Alkali solubility, and the percentage of nitrogen, sulfur, and ash were chosen as measures of chemical change.

* Paper No. 2473, Scientific Journal Series, Minnesota Agricultural Experiment Station, and Paper No. 218, Scientific Journal Series, South Dakota Agricultural Experiment Station.

Methods

Alkali solubility was determined according to the method described by Harris and Smith *(2)*. The nitrogen content was measured according to the Kjeldahl-Gunning-Arnold method. Total sulfur was determined by heating the sample with sodium peroxide in the Parr bomb and was weighed as barium sulfate. The ash content was obtained by ignition. Yarns ravelled from strip-strength samples were used for chemical analyses to insure results which would be comparable with those obtained from the measurement of physical properties. The whole fiber was used in the samples taken for these analyses, the wool being nonmedullated and of fine quality *(1)*. All analyses were made in duplicate to provide a check on results, and all percentages were computed on an oven-dry basis. Mean values for these findings are shown in Table I.[1]

In order to evaluate the significance of these data by means of the analysis of variance, percentage values were transformed to degrees. For this purpose a curve was drawn from values calculated according to the formula used by Bliss *(3)*, i.e., percentage (p) $= \sin^2 \Theta$. The least significant difference was calculated to provide a measure of the significance of the differences observed between pairs of values.

Unless otherwise specifically indicated, all statements drawn from these data are based upon differences between or among values which have been found to be

[1] Certain of these analyses were made by the Analytical Service of the Division of Agricultural Biochemistry, at the University of Minnesota.

TABLE I
Chemical Analyses, Reported in Per Cent, for Three Weights of Wool Serge, When New, and After Dry Cleanings Without and With Wear.

Fabrics	New	Times dry cleaned			Hours worn with dry cleaning		
		5	10	15	1500	3000	4500
ALKALI SOLUBILITY							
12-ounce serge	9.4	11.4	10.6	13.4	12.8	14.4	20.4
14-ounce serge	9.6	11.6	10.3	11.6	13.4	13.6	16.4
16-ounce serge	9.5	10.6	9.5	12.6	12.4	13.3	16.6
NITROGEN							
12-ounce serge	16.4	16.4	16.2	16.0	16.3	15.9	15.7
14-ounce serge	16.6	16.5	16.3	15.9	16.2	16.0	15.4
16-ounce serge	16.5	16.5	16.2	15.9	16.2	16.1	15.5
TOTAL SULFUR							
12-ounce serge	3.45	3.17	3.41	3.46	3.16	3.38	3.17
14-ounce serge	3.46	3.11	3.35	3.51	3.08	3.32	3.18
16-ounce serge	3.24	3.16	3.36	3.11	3.18	3.34	3.13
ASH							
12-ounce serge	0.90	1.06	1.11	1.16	1.26	1.22	0.96
14-ounce serge	0.90	1.02	1.11	1.10	1.45	0.79	1.02
16-ounce srege	0.91	1.08	1.14	1.08	1.36	1.26	1.02

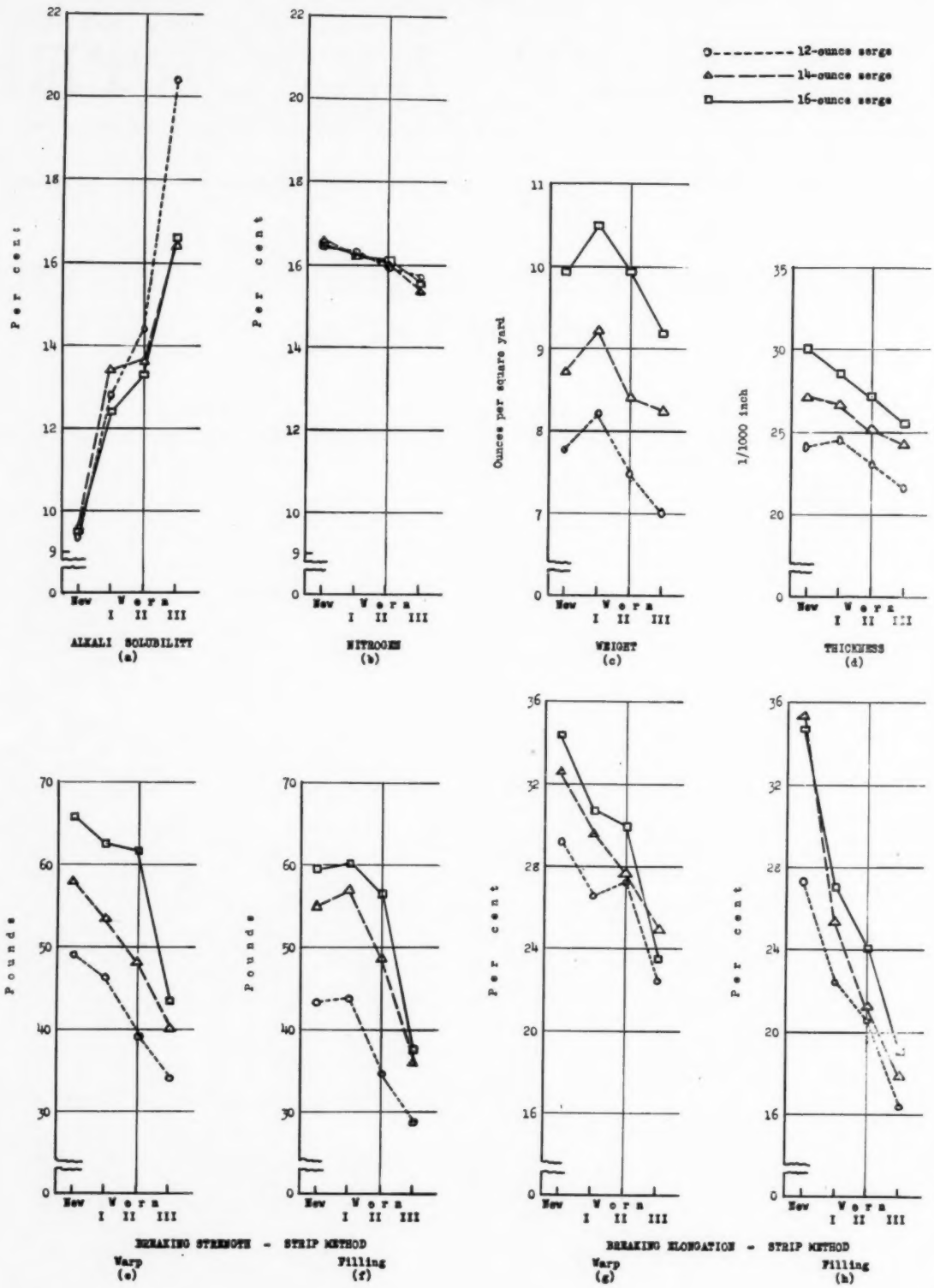

Figure 1—Mean Values for Certain Chemical and Physical Properties of Three Weights of Wool Serge When New and After Three Periods of Wear with Dry Cleaning.

statistically significant. Also, in every case where the term "wear" is used, it is to be understood that each period of wear was accompanied by the appropriate number of dry cleanings.

Findings

ALKALI SOLUBILITY. — A general trend toward increased alkali solubility as wear with dry cleaning proceeded is shown in Figure 1,a. Using values for the new materials as a starting point for both cleaning and wear, increasing numbers of dry cleanings and increasing amounts of wear resulted in highly significant increases in alkali solubility.

Wear alone obviously results in a considerable increase in alkali solubility, since differences in the values obtained for this property, when comparing fabrics which have been dry cleaned only with those which have been worn and dry cleaned, are observed to be highly significant. For each of these fabrics the deterioration indicated by increases in alkali solubility became evident after five dry cleanings and 1500 hours of wear. Considering the three weights of material as a group, the average alkali solubility increased from 9.5 per cent for the new materials, to 12.5 per cent after 15 dry cleanings, and still further to 17.8 per cent after 4500 hours of wear, again highly significant changes in this property. The effects on alkali solubility of wear with dry cleaning, therefore, are more marked than those resulting from dry cleaning alone. Possibly more than half of the deterioration evidenced by increases in alkali solubility after wear with dry cleaning was due to the effects of actual wear.

The extent to which the three different weights of serge might behave similarly or differ in alkali solubility is of special interest since the fiber used in the three serges had been found to be alike as indicated by ellipticity and length *(1)*, and since the fabrics had undergone no known differences in treatment during manufacture, in handling, or in exposure. When new, these three materials also did not differ in alkali solubility. However, a general evaluation of all alkali solubility data indicates some significance in the differences observed for the three weights of fabric. At the same time it can be said that the light-weight, 12-ounce material yielded markedly higher alkali solubility values than did either the 14-ounce or 16-ounce fabric.

In this connection, one is led to suspect that the greater bulk of the two heavier fabrics in some way served as protection against the forces which result in deterioration of the fabric, and that the finer yarns in the 12-ounce serge, when exposed to these influences, fell below some critical point which provides such protection. The difference in behavior observed here may well be related to the differences in yarn number already reported *(1)*.

The increase in the alkali solubility of wool is said by Harris and Smith *(2)* to be related functionally to the extent of the oxidation of the wool. Further, the alkali solubility of the fiber has been claimed by Frishman, Hornstein, Smith, and Harris *(4)* to be an indication of change in the chemical constitution of the fiber which has been caused by oxidizing agents; the determination of alkali solubility has been recommended by Harris and Smith *(2)* as a means of measuring the extent to which wool has been oxidized. In addition, Smith and Harris *(5)* have shown that the increase in alkali solubility is directly proportional to the degradation of wool which results from irradiation. The values reported herein for all three weights of serge, when new, and when dry cleaned only, in general show good agreement with the finding reported by Smith and Harris of 11.9 per cent alkali solubility for worsted top with zero exposure to radiation.

NITROGEN.—For all three pieces of serge, in general, the nitrogen content decreased steadily as dry cleanings and wear increased. Also, a general comparison of the effect of dry cleaning alone with that of wear with dry cleaning yielded highly significant differences in amount of nitrogen found. The mean nitrogen content was lowered from 16.5 per cent for the new materials to 15.9 per cent after 15 dry cleanings, and to 15.5 per cent after 4500 hours of wear with dry cleaning. It is evident that wear is responsible for significant losses of nitrogen from the very start, whereas five dry cleanings without wear did not result in significant decreases in nitrogen, although such losses were observed after 10 dry cleanings. These relationships for the worn fabrics are shown in Figure 1, b. In no case were any significant differences observed among the values for nitrogen reported for the three different weights of material. These observations indicate again the similarity of the fiber used in the three weights of serge.

The changes in total nitrogen, shown here to have resulted from wear and/or dry cleaning during the first two periods, do not differ greatly from the decreases in values for total nitrogen of samples exposed to irradiation in dry and moist air for 266 hours, as reported by Harris and Smith *(6)*. At the same time the amounts of nitrogen reported for these three serges all were greater than those reported by Bailey *(7)* for all-wool flannels when new and after 15 dry cleanings. In addition, Routh *(8)* found that the total nitrogen content of wool after prolonged grinding in a steel ball mill had undergone but little change. This work suggests a possible relationship between the mechanical aspects of grinding and those resulting from wear. In the case of these fabrics which had been exposed to conditions of actual service, it would be impossible to separate the effects due to the mechanical aspects of wear, and those due to other factors of deterioration.

SULFUR.—When comparing all values for the materials which were dry cleaned only with those for the fabrics which were both worn and dry cleaned, no significant differences in total sulfur are found. However, when the values for fabrics worn 4500 hours are compared with those for fabrics dry cleaned 15 times, and with the new, it is observed that for the 12- and 14-ounce fabrics a somewhat greater loss in sulfur results from wear with dry cleaning than from dry cleaning alone. The means for the three fabrics are 3.38, 3.36, and 3.16 per cent for the fabrics when new, dry cleaned 15 times, and worn 4500 hours, respectively. This might indicate that the loss of sulfur reported here is due chiefly to influences associated with wear. Despite the significant differences found in the total sulfur present in these fabrics after various periods of dry cleaning and wear, the data do not permit any definite statement concerning progressive losses which might have been expected under the conditions described.

While a general analysis of these data indicates that there were no significant differences among the three fabrics in sulfur content, comparisons between individual values indicate a lower sulfur content for the 16-ounce serge when new than that found for the other two new serges. Also, the 16-ounce fabric decreased in sulfur content after 15 dry cleanings when compared with the new, while no further decrease was found to result from wear with dry cleaning. Contrarily, 15 dry cleanings resulted in no decrease in sulfur content for the 12- and 14-ounce materials, whereas significant losses are reported for these two pieces of cloth after a similar number of dry cleanings with wear.

These findings for total sulfur are somewhat erratic. Repeated attempts to determine the sulfate sulfur content of these materials consistently indicated that the amount of sulfate found was too small to be measured accurately except on a micro-balance, which was not available.

Considerable variation in the percentage of sulfur found in wools is indicated in a summary prepared by Winton and Edgar *(9)*. Larose and Tweedie *(10)* have discussed the various factors which might affect the variability of the sulfur content of the fiber and have emphasized the importance of the effect of light in this respect. Humfeld, Elmquist, and Kettering *(11)* mention light, together with wa-

ter, mineral and organic acids, alkalies, and other agencies, as being destructive to wool and reductive of its sulfur content. Routh *(8)* found little change in sulfur content after prolonged grinding of wool. The wool in a fabric subjected to the variable conditions of wear, as in the case of these garments, undoubtedly is exposed to the influence of a number of these destructive agencies.

ASH.—In general the ash content of the fabrics studied was found to differ significantly with dry cleaning and wear. The differences shown represent some increases in ash with increasing numbers of dry cleanings when comparing values for the new materials with those for fabrics cleaned 5, 10, and 15 times. At the same time, 1500 hours of wear resulted in marked increases of ash when values recorded are compared with values for the new materials, while increasing wear resulted in losses of ash. From these data it would appear that small amounts of mineral may be picked up in the dry cleaning solution, and possibly to a more marked degree, during the first wear period. In the latter case these greater gains, presumably associated with wear, are completely lost when values for the final periods are compared. An analysis of all values for ash indicates no differences which can be attributed particularly to dry cleaning or to wear. However, the differences observed between the ash content of the new matrials and that of fabrics dry cleaned 15 times, and of fabrics worn 4500 hours with dry cleaning, are highly significant. Bailey *(7)* also has noted exceptions to the tendency for the percentage of ash to increase with an increase in dry cleaning.

Again, these three weights of wool serge were essentially alike with respect to ash content at any point during dry cleaning and wear.

INTERRELATIONSHIPS. — One definite interrelationship has been found among these chemical properties. Alkali solubility increased as the nitrogen content of the fabrics decreased ($r = -0.83^{**}$)[2], a relationship which could be expected to be found in a random sampling 99 times in a hundred. The increase in alkali solubility due to increasing wear and dry cleaning obviously is much greater than the accompanying decrease in nitrogen. In addition, there was some indication that, despite the irregularity of data for sulfur, the sulfur content might be inversely related to alkali solubility ($r = -0.43^{*}$)[3].

A number of interrelationships between two of the chemical properties, alkali solubility and the amount of nitrogen found, and the physical characteristics of these three serges also can be pointed out. Such relationships, after wear with dry cleaning, are shown graphically (Figure 1) by the general shape of curves for the two chemical properties mentioned, and those for weight per square yard, thickness, fabric breaking strength when determined by the strip method, and percentage fabric elongation under stress. Increases in alkali solubility resulting from wear can be seen to be associated with decreases in weight after the first period of wear and are accompanied by decreases in thickness ($r = -0.52^{**}$), in warp breaking strength ($r = -0.67^{**}$), in filling breaking strength ($r = -0.77^{**}$), in warpwise elongation ($r = -0.77^{**}$), and in fillingwise elongation ($r = -0.82^{**}$). It appears evident that as this type of fabric diminishes in thickness and weight due to wear, it not only loses its ability to withstand breaking forces and to elongate, but also loses nitrogen and undergoes changes which increase its susceptibility to solution in dilute alkali. In addition, breaking strength measurements on fabrics exposed to light *(1)* had demonstrated greater losses in the 12-ounce fabric than in the two heavier serges. Similarly, a marked increase in the alkali solubility of the 12-ounce serge was observed after 4500 hours of wear with dry cleaning. It might be assumed, therefore, that a heavier, more closely woven fabric would provide for its component fibers greater protection against the effects of sunlight and oxidation than a fabric as thin and light in weight as the 12-ounce serge. These relationships are similar to those reported by Frishman, et al. *(4)*, whose data indicated that "loss in weight during treatment and alkali solubility correlate with the change in mechanical properties of the wool fibers."

It is recognized that wear is not a single uncomplicated factor which influences the behavior of fiber or cloth. In the course of wear with dry cleaning, the fabric is subjected in varying degree to numerous influences both chemical and physical. One of these components is the action of light. The duration and intensity of the irradiation to which any fabric in a garment is subjected during wear would vary considerably, and would supplement whatever exposure to light the fiber may have undergone while on the back of the sheep. As has been pointed out by Harris and Smith *(12)*, the effects of oxidizing or reducing agents, or of light, on the state of sulfur in wool may result in incipient damage, if not direct degradation, which in turn may be aggravated by subsequent processing. Another component associated with wear and cleaning would be the action of moisture and heat encountered during steam pressing, since Raynes *(13)* has noted that a greater loss of nitrogen from wool is associated with heating in the presence of moisture.

Summary

Alkali solubility, and the percentage of nitrogen, sulfur, and ash, were chosen as measures of chemical change resulting from wear and/or dry cleaning in three weights of new, all-wool serge made into men's trousers and subjected to actual use.

Data show that, in general, alkali solubility increased as dry cleaning and wear with dry cleaning continued, the effect of wear being more pronounced. The three fabrics were similar in alkali solubility when new. However, wear and dry cleaning resulted in some significant differences among the three weights of fabric, that material which was lightest in weight yielding the highest alkali solubility values.

The nitrogen content of the three serges decreased steadily as dry cleanings and wear increased. In no case were significant differences observed among the three weights of material. Wear resulted in significant decreases in the nitrogen content from the very start, whereas the decreasing effects of dry cleaning ere somewhat retarded.

The findings for total sulfur are erratic. However, when values for the 12- and 14-ounce fabrics which were worn 4500 hours are compared with those for new fabrics and with those for materials dry cleaned 15 times, a somewhat greater loss in sulfur appears to result from wear with dry cleaning than from dry cleaning alone. Data do not permit a definite statement regarding progressive losses associated with increasing wear and/or dry cleaning.

Differences noted in ash content represent, in general, some increases with increasing numbers of dry cleanings and some losses associated with increasing wear after the first 1500 hours. An analysis of all values for ash indicates no differences which can be attributed particularly to dry cleaning or to wear. The differences observed between the ash content of the new materials and that of fabrics dry cleaned 15 times and worn 4500 hours are highly significant. The three weights of serge were essentially alike with respect to ash content at any point during dry cleaning and wear.

An attempt to demonstrate relationships among these chemical properties disclosed one definite interrelationship in that alkali solubility increased as nitrogen decreased ($r = -0.83^{**}$). The sulfur content also might be inversely related to alkali solubility ($r = -0.43^{*}$).

Several significant interrelationships were observed between the two chemical properties, alkali solubility and nitrogen content, and such physical properties as

(Concluded on Page 202)

[2] ** indicates significance at the one per cent level.

[3] * indicates significance at the five per cent level.

THE EVALUATION OF ENZYMATIC DESIZING AGENTS*

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Translated by

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Technical Director, Royce Chemical Co.

THE most commonly used material for sizing cotton and rayon warps is potato starch.† In order to guarantee a perfect finish on woven fabrics, it is necessary to remove this starch from the warps. Today, starch-splitting enzyme preparations are used almost exclusively for desizing. These materials accomplish a total conversion of the starch film into end-products which are easily removable by washing, without damage to the fabric. The effective ingredients of enzymatic desizing preparations are the amylases. Enzymes are generally considered to be organic catalysts of biological origin. Enzymes are water-soluble and protein in nature. They may be of vegetable or of animal origin. Substrate specificity is characteristic of the enzymes. That is to say, a certain enzyme can only act upon one specific material or on one particular linkage in a particular group of materials, from which property the enzyme derives its name. Those enzymes which hydrolyze starch (amylum) are thus called amylases.

Many questions as to the action of the amylases have been by no means completely cleared up. The constitution of the amylases is not known, neither has the question as to the structure of starch been solved. K. H. Meyer *(15, 44, 45)* recently isolated the amylase of pancreas and saliva, as well as the bacterially produced "Biolase" of Kalle, in a pure crystallized form. Some progress has been made in the investigation of the constitution of starch, but concerning the most important question of the amylase reaction, we are still in the dark, and a certain amount of confusion prevails.

1. The Composition of Starch

The various types of starch, potato, corn, rice, arrowroot, etc., do not differ substantially one from another. Acid hydrolysis of the starches yields glucose, while enzymatic hydrolysis gives maltose as the end product. From this it can be deduced that starch is a polymerization product of glucose (or of maltose). However, its composition is not uniform. By various methods it can be separated into two parts, namely, about 20% amylose and about 80% amylopectin. It is possible to hydrolyze the amylose with acid quantitatively to glucose. No other constituents can be detected. Amylopectin, on the other hand, according to Myrback *(1)* contains, in addition, some phosphoric acid. The phosphoric content in potato starch, however, is less than 0.1%.

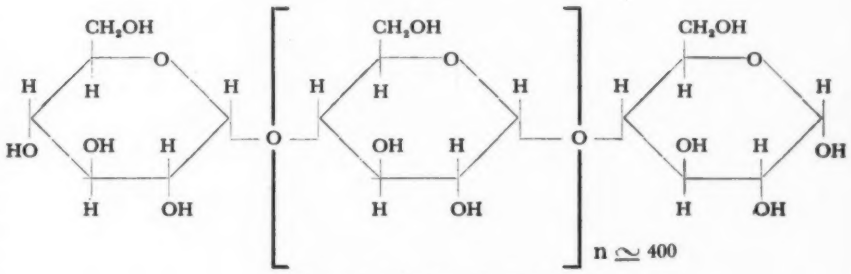

Figure 1—Amylose Formula

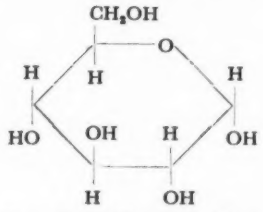

Figure 2—α-Glucose (α-Glucopyranose)

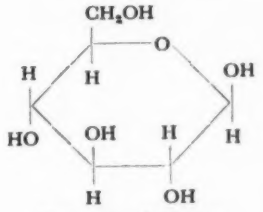

Figure 4—β-Glucose (β-Glucopyranose)

AMYLOSE.—According to K. H. Meyer, *(2, 3)* amylose consists of long, unbranched chains of α-glucopyranoses (Fig. 2). Cellulose is built quite similarly; it also consists of glucose groups. In contrast to amylose, cellulose consists of only β-glucoside linkages *(6)* (see Figs. 3 and 4). Amylose dissolves in water without forming a paste. Its solutions are colored blue by iodine. According to Hassid and McCready *(4)*, the solubility of amylose in water is 0.1%. β-amylase, derived from malt, converts amylose 100% into β-maltose (Fig. 6). From this fact it can be concluded, as will be shown below, that amylose is built up of unbranched chains. Following the viscosity method of Staudinger, Hassid and McCreary *(4)* found the molecular weight of methylated amylose to be about 50,000. Meyer, Noelting and Bernfeld *(46)* by measuring the number of free aldehyde groups, have calculated the molecular weights of various amylose fractions as from 13,000 to 340,000. From the yield of tetramethyl glu-

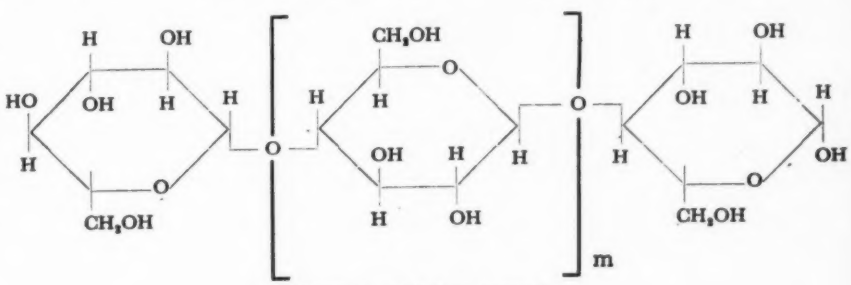

Figure 3—Cellulose Formula

* Translated from Textil-Rundschau, Nos. 9 and 10, 1948.

† In the U. S., corn starch is most commonly used.

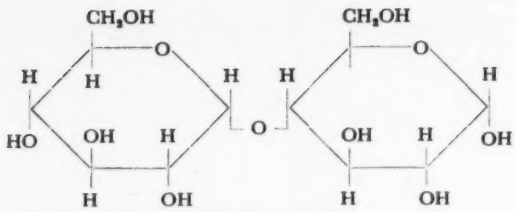

Figure 5—α-Maltose

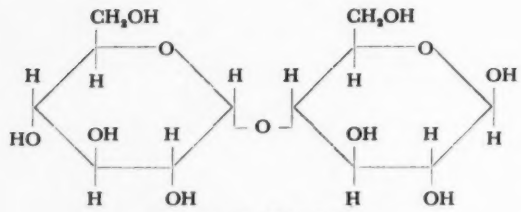

Figure 6—β-Maltose

cose (which is only formed from the terminal groups) from methylated amylose, Hassid and his coworkers *(4)* arrived at a molecular weight of 80,000. Calculated from this, the chain length is about 400 glucose units. By means of electro-dialysis, Samec *(5)* separated starch into amylopectin and amylose. He found that the amylose fraction from corn starch is identical with that from potato starch.

AMYLOPECTIN.—While it is certain that the constitution of amylose is that of a linear molecular chain, the construction of the amylopectin fraction is still uncertain. Amylopectin is responsible for the paste-forming property of starch. It gives a violet coloration with iodine. According to Meyer and his associates *(2, 3)* the amylopectin fraction is built up of branched chains. Therefore the different behavior of amylose and of amylopectin is understandable. β-amylase from malt hydrolyses amylopectin with production of about 50% maltose and 50% β-limit dextrine which resembles starch in its properties. Viscosity and iodine coloration properties are retained by β-limit dextrines. K. H. Meyer (32) finds that β-amylose decomposes 62% of starch and concludes therefrom that since 1 to 2 glucose residues remain in the branching places of the amylopectin, that at least 67% of the glucose molecules are combined in free chains.

Hopkins, Murray and Lockwood *(33)* find that by the action of highly purified β-amylase on soluble starch and potato starch at pH 4.6, that decomposition of 56 to 57% takes place. They ascribe the differing results reported in the literature to small traces of α-amylase (perhaps of bacterial origin) in the β-amylase used. Hassid and coworkers *(4)* give methylated amylopectin a molecular weight of 92,000 and a tetramethyl glucose content of 4.67% from which they deduce an average chain length of about 25 glucose molecules between the branching places. Against this Haworth finds for β-dextrine (limit dextrine from β-amylase), which, according to the aforementioned, constitutes 50% of the amylopectin fraction, a molecular weight of 79,000 and assumes a chain length of 11 to 12 units. (It must be observed that Haworth has a different conception of "chain length" than that of Hassaid and his coworkers, among others). According to Haworth, amylopectin appears to contain an average chain length of 22 to 24 glucose molecules. The interpretations of Samec *(5)* are somewhat different.

The branch linkages in amylopectin are 1:6-α-glucosidic bonds, while all other maltose linkages are 1,4-bonds. Fig. 7 illustrates diagramatically this branching.

That 1,6-α-bonds actually exist in the branching places in the amylopectin was made plausible by Freudenberg *(43)* by estimation of the decomposition products of methylated starch.

Haworth assumes that the amylopectin exists in the form of a laminated structure as shown in Fig. 8. Samec's *(5)* idea is illustrated by Fig. 9. An entirely new proposal for a formula for amylopectin has recently been made by Pacsu *(6)*.

He suggests a three-dimensional network of glucose anhydrides with 1,4-α-glucosidic linkages. At fixed distances semiacetal or acetal linkages of open glucose anhydrides or open glucose or maltose molecules occur. Fig. 10 gives an idea of the arrangement. Pacsu finds the basis for this conception in the extreme susceptibility toward acid hydrolysis. He found that not only 0.1 N sulfuric acid and 0.05 N hydrochloric acid but also organic acids, such as formic acid, acetic acid or citric acid, completely hydrolyze these 1,6-glucosidic linkages at 80-86°C., whereby linear molecular chains are formed. The 1,4-glucosidic linkages do not show this sensitivity toward acid hy-

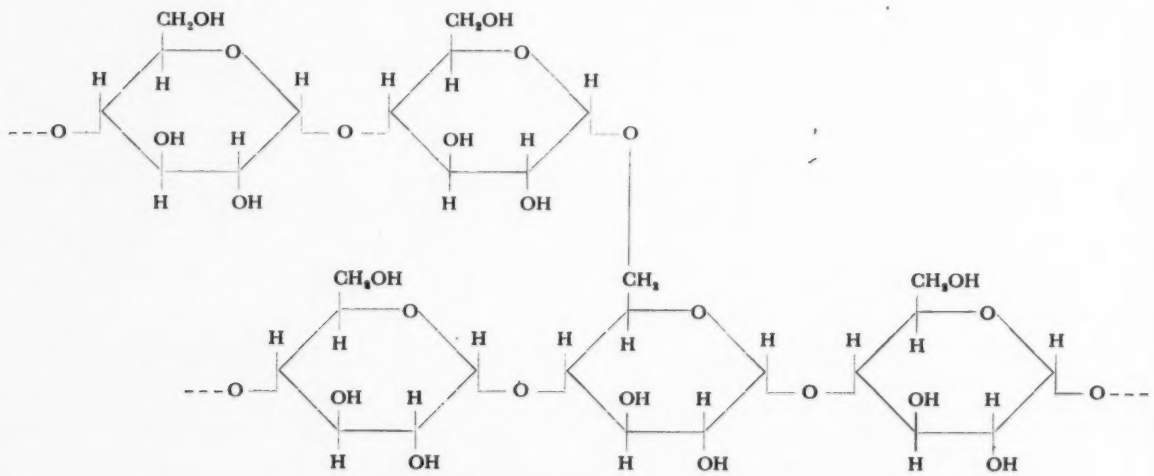

Figure 7—Branching Places in the Amylopectin

drolysis. According to Pacsu, the end-product of this acid hydrolysis is a substance similar to amylose (precipitable with polar reagents, giving blue coloration with iodine, etc.).

These views as to the nature of amylopectin, supported by the measurement of activation energy of 1,6- and 1,4-glucosidic linkages by Bawn, Hirst and Young *(48)*, are of great theoretical significance. The circumstances that starch can be "liquefied" by the action of α-amylase, without any increase in reducing power and without any dextrinization (see further below), thus finds a simple explanation as a result of this interpretation. The cause of the liquefaction of starch by α-amylase is considered due to the easy splitting of the 1,4-glucosidic linkages by this ferment, whereby the net-like structure of the amylopectin disappears and with it the viscosity of the amylopectin sol.

2. The Amylases of Desizing Agents

It is easy to see that the chemistry of the reaction of amylase cannot be understood without knowing the properties of starch. In the same way, the chemistry of starch can be just as little understood without a knowledge of the properties of the amylases. For this reason, we have first dealt with starch.

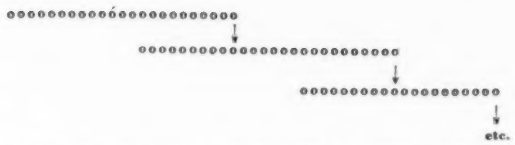

Figure 8—Haworth's Amylopectin Structural Scheme

Figure 9—Samec's Structural Scheme for Potato-Amylopectin

For the purpose of desizing, animal, vegetable and bacterial amylases come into question. To the amylase preparations of animal origin belong the pancreatic products such as "Novo-fermasol", "Degomma", etc. Amylases of vegetable origin are chiefly obtained from barley malt. Wheat and other malts can also be used. Examples of malt enzymes are "Ferment D", "Diastafor" and similar products. Bacterial amylases are "Rapidase", "Superclastase", "Biolase" etc.

The pancreatic preparations are prepared from the pancreas of pigs. The malt preparations are concentrated extracts made from malt rich in diastase. Bacterial amylases for desizing are made by culture of *B. subtilis* or *B. mesentericus* on suitable nutritive media. The filtered and concentrated culture fluid is used directly, or precipitated with alcohol, acetone or other materials. The three types of amylase have sharp points of difference one from another. A special position is occupied by the malt amylases and we will consider these first. A comprehen-

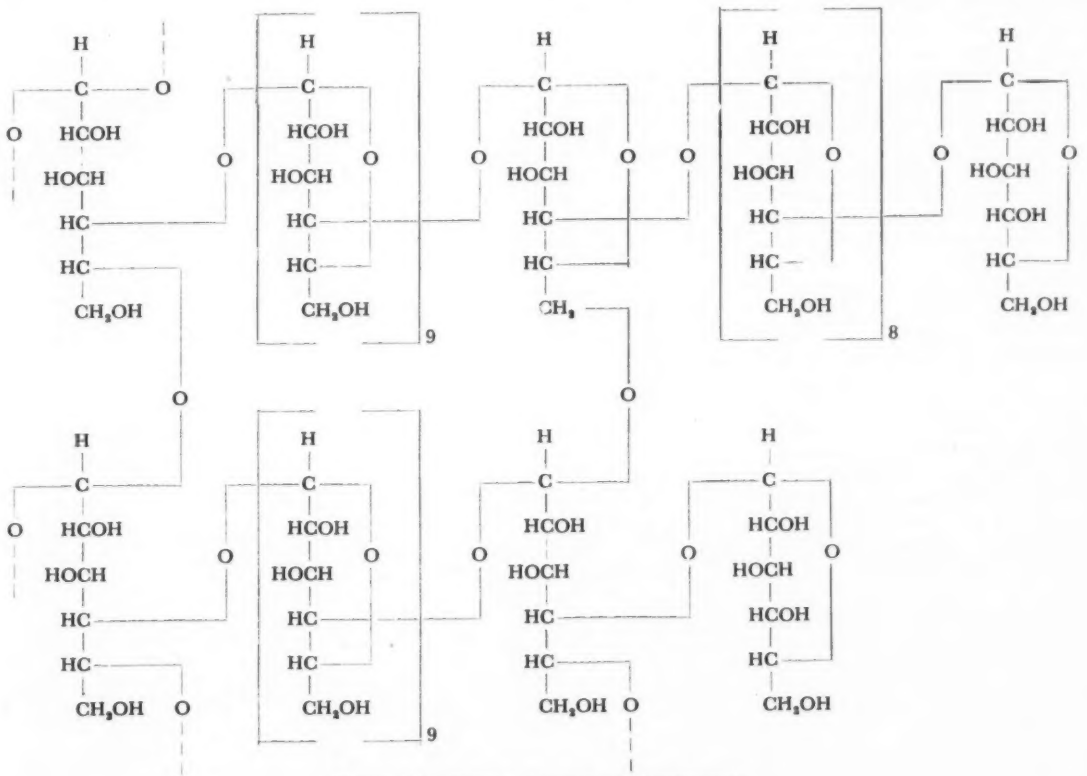

Figure 10—Pacsu's Formula of Amylopectin

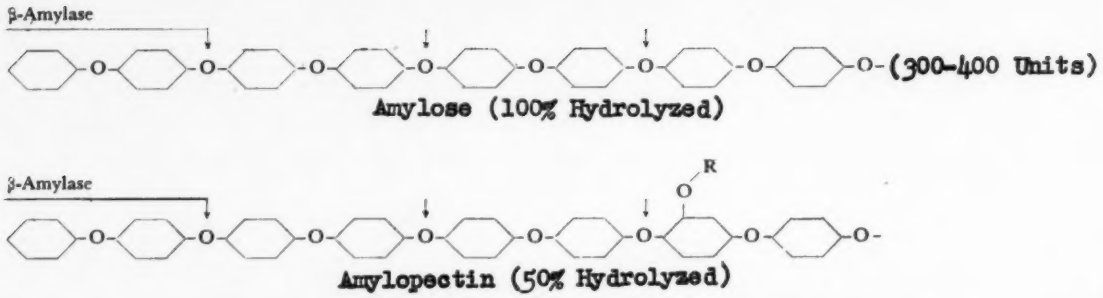

Figure 11—Visualization of the Action of β-amylase by McCready and Hassid

sive presentation regarding the amylase reaction has been given by Hopkins *(7)*. The amylases are hydrolytic enzymes (hydrolases). As the name implies, they hydrolyze starch (amylum). They also attack glycogen and certain dextrines. The action of amylases manifests itself in three ways:

1. By "liquefaction" of starch pastes,
2. By eliminating the iodine coloration,
3. By converting starch into sugar or reducing dextrines.

Hence one speaks of "liquefaction", "dextrinization" and "saccharification."

3. Malt Amylases

Most difficult to understand is the chemistry of the malt amylases. Malt contains two starch splitting enzymes, known as α- and β-amylase. α-Amylases are so called because they are the components which set free the corresponding dextrines and maltose in the α-form. (See Fig. 5). β-Amylase correspondingly liberates maltose in the β-form (See Fig. 6). It is not true that α-amylases hydrolyze α-glucosidic linkages and β-amylases act upon the β-glucosidic linkages, as starch only contains α-glucosidic linkages. Just how the β-amylase liberates maltose in the β-form is not clear. The differences between the two amylases are much more fundamental than the names seem to indicate. β-amplase can only split off the terminal maltose molecule, and that only from the nonreducing ends (Hopkins, Murray and Lockwood *(33)*. Amylose is thereby converted into 100% maltose. No glucose is produced. On the other hand only 50% of the amylopectin is converted by β-amylase into maltose, 50% remaining as unconvertible β-limit dextrine. Hassid and McCready *(4)* visualize the action of β-amylase on amylose and amylopectin in Fig. 11.

α-Amylase tears apart the starch molecule at any place, even breaking the linkages at the branching places, while β-amylase stops short at these places. According to K. Myrback, linkages further than 5 to 6 glucose units from the terminal group are preferred. At first, no maltose results from the action of α-amylase, but only dextrines of more or less high molecular weight, which of course, in time, are converted into maltose. By the action of α-amylose on starch pastes their viscosity is rapidly lowered. β-Amylase, on the contrary, has no influence on the visocity of starch pastes, as the β-limit dextrines still form pastes. Under the action of α-amylase the coloration produced with iodine on the starch changes from blue to violet through red and brown and finally to colorless. This process is called dextrinization. As β-limit dextrine still shows a violet coloration with iodine, β-amylase has no dextrinizing action.

Characteristic of the action of β-amylase on starch is the formation of maltose (saccharification). On this account β-amylase is called saccharogenic amylase. Characteristic of the action of α-amylase is liquefaction or dextrinization, for which reason malt-α-amylase is also known as dextrinogenic amylase. The progress of the working of α-amylase can be measured, as in the case of β-amylase, by the rising reducing power of the digestion mixture, which is proportional to the liberated aldehyde groups. It is usual to refer to the increase in reducing power merely as "saccharification", whether it is really sugar formation as in the case of β-amylolysis, or whether the reducing power is due to dextrine, as in the case of α-amylolysis. In connection with the action of β-amylase the expression "saccharification" is correct. With α-amylases, where sugar is not originally formed it is well to remember that this expression is incorrect. It is therefore purely a matter of form if the hydrolyzed product, in spite of the reducing potential, is reported as milligrams of maltose. But, as the reducing potential is a measure of the free aldehyde groups, this method of reporting is nevertheless convenient.

While β-amylase can form from 54-62% maximum maltose from starch, for α-amylase no sharply defined limit can be determined. Indeed toward the end of the reaction a sharp retardation occurs which must be explained by a loss of affinity of the α-amylase for the dextrines of lower molecular weight. Maltose is not attacked by α-amylase. Hopkins and Kulka *(34)* assume that a maximum of 90% of the theoretical yield of maltose is formed by α-amylase. According to the aforementioned investigators, after 30-40% completion of the action of α-amylase, a distinct slowing of the reaction occurs. The reaction curve is therefore somewhat like that shown in Fig. 12.

Schwimmer was able to show that raw starch can be entirely digested by α-amylase, providing that the resulting maltose be removed, either by dialysis or by the action of maltase. This finding might admit of the interpretation that there might be an equilibrium reaction between dextrine and maltose:

$$\text{dextrine} \xrightarrow{\alpha\text{-amylase}} \text{maltose}$$

$$\text{maltose} \xrightarrow{\alpha\text{-amylase}} \text{dextrine}$$

It is already known that enzymes have synthesizing properties.

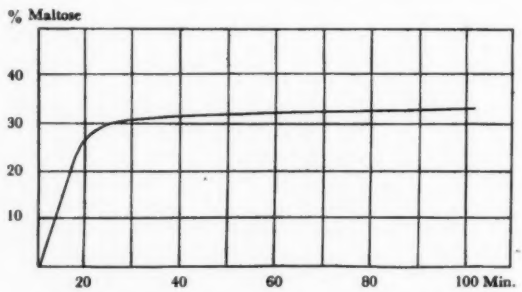

Figure 12—The Reaction Curve for α-amylases

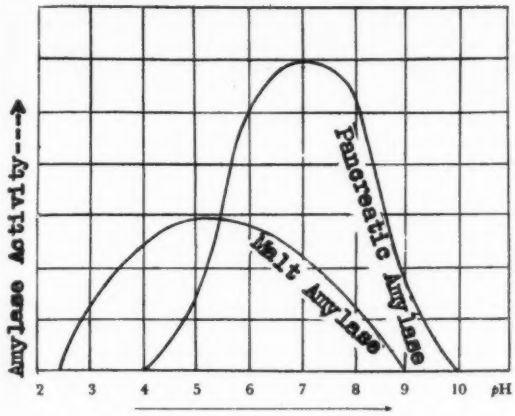

Figure 13—pH Curves of Pancreas- and Malt Amylase

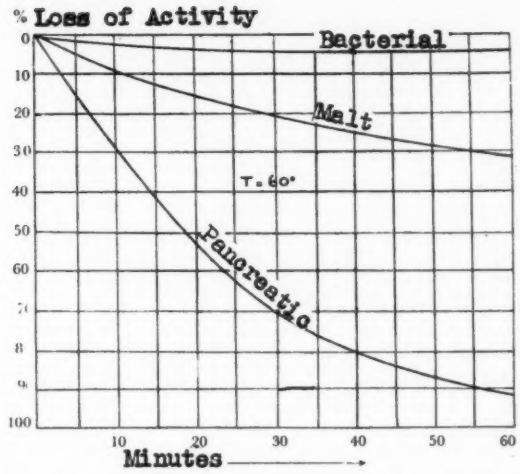

Figure 14—The Loss of Activity of the Different Amylases at a Temperature of 60°C.

Furthermore it should be borne in mind that glucose is also formed in the reaction of the dextrinogenic amylase (malt-α-amylase); on account of this, the calculated maltose yield resulting from the reducing action should be taken with reserve.

If the action of malt amylase (α- + β-amylase) on starch paste is expressed in milligrams of maltose, it appears, according to Kneen and Sandstedt *(8)*, that the α-amylase portion of the malt constitutes about 10-25%. Malt therefore contains, as a rule, from 4 to 10 times more β-amylase than α-amylase.

Unmalted barley contains such a small quantity of α-amylase, that its presence is disputed (see, for example, Hills and Bailey *(9)*). During the germination (malting) of barley, its saccharification power increases about 25-30%. This increase is due to the α-amylase formed. The β-amylase activity remains constant during malting. β-Amylase also occurs in cereals and in sweet potatoes (*Ipomea Batata) (10)*. Balls, Thompson and Falder *(11)* have obtained this enzyme in crystalline form. Wheat flour contains practically only β-amylase and can be used as a source of this enzyme. The separation of α- and β-amylase from malt extracts can be accomplished by taking advantage of their different behavior toward calcium ions, heat and acid pH. We have successfully used the method of Olson, Burkhart and Dickson *(13)*. The method depends on the fact that α-amylase, in the presence of Ca ions with heat (70°C.) for 15 minutes, is only slightly destroyed (about 10%) while β-amylase, under the same conditions, is almost quantitatively eliminated. On the other hand, in the absence of Ca ions at pH 3.3 and at a temperature of 0°C., for 15 minutes, β-amylase is hardly affected at all, but α-amylase is almost entirely destroyed.

The optimum pH range for malt amylases lies between 4.6 and 5.2.

4. The Remaining Amylases

As we have already seen, the rest of the amylase preparations that are used for desizing are free of β-amylase. Pancreatic amylase has a relatively low optimum temperature between 40 and 55°C. The active pH range is more limited than that of malt amylase, as shown in Fig. 13.

Pancreatic amylase is powerfully activated by sodium chloride; the other amylases are not activated by NaCl or are inactivated by it. Calcium chloride has a favorable stabilizing effect on all α-amylases. In consequence of this fact, relatively higher temperatures can be used when hard water is employed for desizing or when calcium chloride is added to the bath. We found that a 1/100 molar solution is sufficient. The keeping qualities of pancreatic amylase preparations is relatively limited, especially when the material is not kept dry in storage. Bacterial preparations, on the other hand, have good keeping qualities, even in solution. Fig. 14 shows the loss of activity of pancreatic malt and bacterial amylases with the passage of time at 60°C. in the presence of stabilizing salts.

Although the low heat stability of the pancreatic amylase preparations seems to put them in a poor light, they possess considerable advantages over the bacterial preparations. Pancreatic preparations contain much more amylase than the bacterial preparations. At 40°C. they work exceptionally well, while the bacterial amylases give no satisfactory desizing at this temperature.

Table I gives a survey of several characteristics of four different amylases which play a role in desizing.

Regarding the data on the temperature and pH optimum, it is important to state that optimum pH may vary considerably, under certain conditions, such as concentration of the enzyme, concentration of the substrate, the addition of various salts change in temperature, etc. Thus there are plenty of exact details regarding optimum requirements for successful desizing. Optimum temperature is a relative term. It is easily understood that the so-called "optimum temperature" must be regulated according to the duration of the desizing operation; for a shorter time, a higher temperature would be better than for a longer time. To express it more precisely: the activity at a given temperature for a given time is equal to the difference between the initial activity and the inactivation which takes place. By initial activity we mean the activity at the given temperature which the enzyme possesses before any inactivation has occurred. If a speedy enough method is used, it is possible to estimate the original activity by analysis. The inactivation is then equal to the difference between the original activity and the effective activity after a given time, at constant temperature, according to the formula:

$I_t = A_o - A_t$ or $A_t = A_o - I_t$

where I_t = inactivation during time t, A_o = original activity and A_t = activity

TABLE I

Enzyme	*Optimum pH*	*Optimum temperature*	*Influence of*	
			NaCl	*$CaCl_2$*
Pancreas	6.8-7-0	40-55°C.	pos.	pos.
Malt α-amylase	4.6-5.2	55-65°C.	neg.	pos.
Malt β-amylase	4.6-5.2	40-50°C.	neg.	neg.
Bacterial amylase	5.0-7.0	60-70°C.	indiff.	pos.

after time t.

Likewise we cannot speak simply of optimum temperature. One can only speak of an optimum temperature for a particular time reaction (duration of desizing operation). For a constant reaction time, the optimum temperature is that temperature T, at which A is a maximum. In other words, the inactivation is a function of the duration of the reaction and the temperature:

$$I = f(t, T)$$

If t is kept constant, I becomes greater with increasing temperature. If T is kept constant, I becomes greater with increasing time of reaction t.

It is therefore clear that in the temperature range in which inactivation of the enzyme takes place (this occurs at 40-45°C.), the optimum enzyme reaction cannot be expressed as a function of the temperature alone. Exact details as to optimum temperature cannot be given definitely. It is generally true:

The longer the time of the reaction, the lower the temperature and vice versa; the higher the temperature, just so much more quickly must the reaction (desizing) be completed (compare Clause *(49)*). According to the method of desizing, a temperature must be selected to allow of optimum utilization of the enzyme.

5. Methods of Analysis

For analytical evaluation of desizing agents three principal ways are available:

1. Determination of the increase in reducing power (saccharification)
2. Determination of the reduction in viscosity (liquefaction) and,
3. Determination of the coloration with iodine (dextrinization).

For the estimation of β-amylase only the first method comes into consideration, according to what has been said.

The liquefaction methods measure only the α-amylase activity, even in the presence of β-amylase.

The dextrinization methods, when α- and β-amylase are both present, measure the combined reaction of both enzymes, as will be presently shown.

Hollenbeck and Blish *(30)* and also Olson, Burkhart and Dickson *(13)* make it appear likely that dextrinization and liquefaction are produced by the same enzyme. But how does it happen then that the dextrinization is influenced by β-amylase, but not the liquefaction, when we are dealing with the estimation of one and the same process but with different agents? Taking into consideration that the enzyme concentrations used in liquefaction processes are much lower than those in dextrinization methods, this contradiction can be explained. For example, in the liquefaction method of Landis and coworkers *(20)* a concentration of 5 mg. malt extract per liter of starch paste is used. Dextrinization with the same malt requires 2000 mg. per liter, or 400 times as much. Liquefaction occurs at an earlier stage than the dextrinization. β-Amylase is not active in the liquefaction. Olson and associates *(13)* showed that liquefaction is influenced by β-amylase in higher concentrations. As liquefaction by α-amylase takes place at an earlier stage than dextrinization, it follows while, after a 90% drop in viscosity, only 2.5% dextrination takes place *(30)*, on the other hand, liquefaction can occur in which neither dextrine nor sugar can be detected.

For the estimation of saccharification there are a great number of analytical procedures. Frequently used are the methods of Lintner, of Willstätter and Schudel *(50)*, of Hagedorn and Jensen *(51)*, Windisch-Kolbach etc., and recently also in America the Kneen-Sandstedt method *(8)*.

The Willstätter method oxidizes the sugar formed with alkaline iodine solution. After acidifying, the solution is then titrated back with thiosulfate to determine the excess iodine:

$$CH_2OH.(CHOH)_4.CHO + I_2 + 3NaOH = CH_2OH.(CHOH)_4.COONa + 2NaI + 2H_2O$$

Hagedorn and Jensen oxidize with alkaline ferricyanide solution and precipitate out the ferrocyanide formed with zinc sulfate. The excess ferricyanide is estimated by titration with iodine:

$$2K_4Fe(CN)_6 + 3ZnSO_4 = K_2Zn_3[Fe(CN)_6]_2 + 3K_2SO_4$$

$$2H_3Fe(CN)_6 + 2HI = 2H_4Fe(CN)_6 + I_2$$

The Sandstedt-Blish method is a modification of the Hagedorn-Jensen method.

More seldom, analyses are carried out by the liquefaction principle. The literature regarding these is scanty. We had very good results with the Jozsa and Johnston method *(21)* as improved by Landis and Redfern *(20)*.

For determination of the degree of dextrinization, that is to say the progressive alteration of the coloration of the starch by iodine during the amylase reaction, many methods are available. These are all based on the Wohlgemuth method of 1908. Simple methods for the use of the textile processor are given by Rath *(14)* and Wood *(23)*. As already indicated, the dextrinization methods measure the combined reaction of α- and β-amylase, when both are present.

Sandstedt, Kneen and Blish *(12)* have developed a dextrinization method which, even in the presence of β-amylase, measures only the α-component. Instead of the soluble starch usually employed as substrate, β-limit dextrine is used, with an excess of β-amylase. On this substrate, the β-amylase contained in a solution of α-amylase has no action at all. Thus we can distinguish between dextrinization, (α-plus β-amylase) and α-dextrinization (α-amylase alone).

Hopkins and his coworkers showed *(33)* that, after the "building up" of 24-25% maltose, the coloration with iodine has already disappeared. It cannot be concluded that complete saccharification has taken place because of the disappearance of the iodine coloration. The average molecular weight of the material at this stage corresponds to about six glucose units. Myrback *(52)* finds, for instance, the relation between chain length and iodine coloration shown in Table II.

The fundamental difference between α- and β-amylase lies in the fact that while α-amylase, after effecting 25% "saccharification," gives no coloration with iodine, β-amylase, after effecting 54 to 60% saccharification still shows a violet coloration with iodine. According to Hanes and Cattle *(40)*, the acchroic point, when the iodine coloration disappears, takes place with malt-α-amylase at 30%, with fungal amylase at 46% and with pancreatic amylase at 55% saccharification. Hopkins concludes from this, that malt α-amylase has a greater affinity for α-dextrines than the other amylases mentioned.

6. What Role Does β-Amylase Play in Dextrinization?

As it has now been established that β-amylase alone has neither dextrinizing nor desizing properties, but that, on the other hand, in the combined action of α- and β-amylase, the influence of the latter is quite considerable, we will clarify the relationship somewhat more exactly. Kneen *(25)* found that the dextrinization activity of α-amylase on starch, in the presence of sufficient β-amylase, can amount to 5.4 to 6 times the activity of pure α-amylase.

Our own researches led to similar conclusions. We prepared an α-amylase solution by partial inactivation of a 10% malt extract, according to the method of Olson and coworkers *(13)*. A determination of α-amylase using the method of Landis and Redfern *(20)* showed 310 liquefons per gram of the dry material.

We also determined the saccharification and dextrinization powers. The respective figures are shown in Table III. A 10%

TABLE II
Chain Length and Iodine Coloration

Number of glucose units	*Iodine coloration*
22	Red violet
15	Red brown
10	Colorless

TABLE III
Influence of β-Amylase on Dextrinization

α-Amylase cc.	β-Amylase cc.	Saccharification Units	Dextrinization Units	α-Amylase (Liquefons)
0.5	—	3.4	100	310
0.5	0.5	9.7	180	310
0.5	1.0	16.0	255	310
0.5	2.0	28.6	384	310
0.5	3.0	41.2	471	310
0.5	4.0	53.8	501	310
0.5	5.0	66.4	516	310
0.5	6.0	79.0	525	310

TABLE IV
Relation Between α-Amylase, β-Amylase and Dextrinization

Malt No.	β-Amylase A	α-Amylase 5.4 B	A + B	Dextrinization units
1	30.5	11.9	42.4	38.9
2	23.4	27.0	50.4	51.7
3	25.3	18.8	44 1	42.3
4	20.2	12.2	32.4	34.6
5	18.5	8.1	26.6	26.7
6	8.8	11.3	20.1	19.9

extract of wheat flour was used as the source of the β-amylase.

5 cc. portions of α-amylase were treated with increasing amounts of β-amylase and brought to a volume of 10 cc. with water and 0.5 cc. of buffer solution (pH 5.1). The solutions made up in this manner, all containing equal quantities of α-amylase, but increasing quantities of β-amylase were dextrinized at 30°C. From Table III and Fig. 15, the relationship between the increase in saccharification power and dextrinizing power is seen. With 15-fold increase in saccharification power, the dextrinizing power rises 5-fold.

Further addition of β-amylase has no significant effect; the curve changes into a straight line. As the proportion of α-amylase to β-amylase in malt is normally from about 1:4 to 1:10, extreme values consequently do not occur. It is possible to formulate a relation between dextrinization units and α- and β-amylase units and, with the help of two known figures, the third can be calculated. Kneen, Beckford and Sandstedt *(27)* found that this equation:

$$\text{β-amylase units} + \frac{\text{α-amylase units}}{5.4} = \text{dextrinization units}$$

is true when the β-amylase units are determined according to the method of Kneen and Sandstedt *(8)* and the dextrinization units following the method of Sandstedt, Kneen and Blish *(12)*. From Table IV, it is manifest that the relationship is actually in good agreement. But as the β-amylase accomplishes the major part of the saccharification of the malt, it is also possible, for quick approximation, to use the total saccharification units instead of the β-amylase units. Accordingly then, from the dextrinization and the saccharification the α-amylase can be determined or, from the saccharification and the liquefaction (α-amylase) the dextrinization can be estimated. It is important to remember that in any event calculation of either of the other two figures cannot be derived from *one figure alone.*

While the just named relation between α-amylase, β-amylase and dextrinization only obtains when the relative values of α- and β-amylase vary within a specific range, and has therefore a limited applicability, from α- and β-amylase values the saccharification values for all mixtures of malt enzymes can be calculated. See Table V (from Kneen and coworkers *(27)*). The equation is: A = B + D/20 or, in other words:

Malt saccharification = β-amylase units + α-amylase units/20

when, once again, the same methods of determination of amylases as those given above are used.

To summarize, we now know that liquefaction only measures the α-amylase, while saccharification measures the sum of α- and β-amylase saccharification, independent of the relative proportions of the two components. Dextrinization measures finally the combination of the reaction of both α- and β-amylase, and is influenced equally by the absolute as by the relative quantities of both the components. Hence, none of the three methods of analysis is equivalent to either of the others.

TABLE V
Relation of Various Amylase Values to One Another

Malt No.	A Malt Saccharification	B β-Amylase Units	C Dextrinization Units	D α-Amylase (α-Dextrinization) Units	Liquefaction
1	33.7	30.5	38.9	64.6	1227
2	30.6	23.4	51.7	145.5	2876
3	30.3	25.3	42.3	101.3	2060
4	23.9	22.4	22.8	30.8	602
5	26.6	20.4	34.6	66.1	1227
6	20.7	18.5	26.7	43.5	787

TABLE VI
Agreement Between Liquefaction and Dextrinization of Pure α-Amylases

α-Amylase concentration	Relative units	
	Liquefaction	Dextrinization
1.0	100	100
0.5	51.7	48.8
0.25	25.5	24.4

7. Which Analytical Method is Suitable for Evaluation of Desizing Agents?

(A) COMPARISON—In handling amylase preparations of the same origin, for standardization or control, in principle all of the methods are suitable.

Redfern and Landis *(24)* on the one hand, show that pure α-amylase by itself, both by the dextrinization method and the liquefaction method, gives results which are parallel, (see Table VI).

Kneen *(25)*, Kneen and Sandstedt *(8)* and Olson, Evans and Dickson *(26)* on the other hand, show that α-amylase content and saccharification run parallel. In other words: In the comparison of pure amylases with one another, all three of the analytical methods are suitable, but not for malt preparations. This statement, according to our latest results, requires limitation. We have been able to demonstrate that under some circumstances enzyme preparations from the same source (pancreas) can be incorrectly evaluated by enzyme analysis. Certain additions cause quite different results by enzyme analysis and estimation of desizing power. From the same raw material, we have come across preparations showing the same analysis in comparison with a standard preparation, that showed three-fold the desizing power. In order to explain this peculiar phenomenon, the fundamental difference between the analytical test and the desizing trial must be understood. In the first case, we are dealing with the action of amylase on a colloidal starch solution, whereas in the latter case, we are concerned with the reaction of amylase on a dried starch film. Compare, for example, the two Fermasol brands F and G. Fermasol F has a considerably higher amylase content than Fermasol G. In spite of this, the desizing action of the G brand is significantly better. The conclusion to be drawn from what has been said is: Only preparations of the same

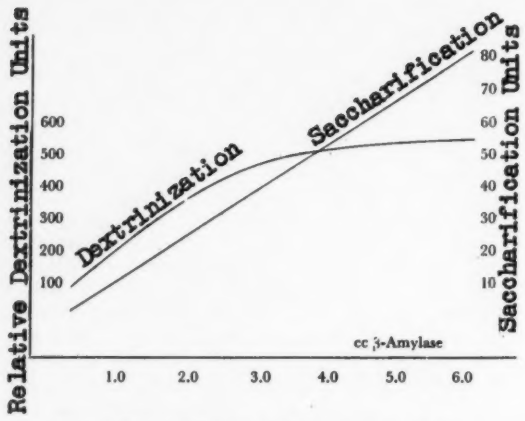

Figure 15—Influence of β-Amylase upon the Dextrinizing Power of Malt-α-Amylase

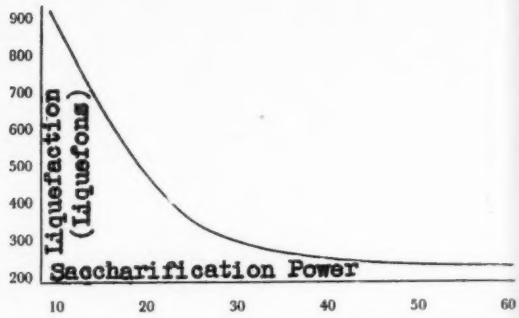

Fig. 16—Relationship Between Saccharification and Liquefaction in Connection with Equal Dextrinization of Malt Preparations

composition (that is to say, the same enzyme material and the same additions) can be compared analytically with reference to their desizing action. In all other cases, only a desizing test can give a definitive result. It is clear from the foregoing paragraphs that the saccharification accomplished by malt preparations is no measure of the desizing power, as in that case a pure β-amylase preparation would be equivalent to a pure α-amylase preparation with the same saccharification power, whereas, as a matter of fact, β-amylase shows no desizing power. But on the other hand, as the liquefaction methods only measure the α-amylase content, the β-amylase, which has an influence on both dextrinization and desizing, in the presence of α-amylase, would not be taken into account; for this reason the liquefaction method is not useful for malt preparations. We have examined the question of the agreement between dextrinization power and desizing power in our laboratory. We prepared malt extracts with varying proportions of α-amylase and β-amylase, but of the same dextrinizing power, and carried out practical desizing tests with these solutions. We varied the β-amylase content from 0 to 95% and determined the liquefaction and saccharification powers. Table VII gives the relative composition of the individual baths (see also Fig. 16).

We found the same desizing power in every case according to the desizing test, which was carried out as follows:

We desized at 35°C. and at pH 5.1. If the desizing is done at temperature above 45°C., heat inactivation occurs. As the β-amylase is more sensitive to heat than the α-amylase, a disintegration of the amylase mixture takes place at these temperatures. It can be concluded, therefore, that in the case of malt preparations of the same dextrinization power, those with higher α-amylase content are more valuable (as they are more heat resistant). This may well be so in many cases. But it must not be forgotten that α-amylase has the serious drawback of being sensitive to acid. This interlacing of both these effects on α- and β-amylase is well illustrated in Table VIII.

At pH 4.0 and 50°C. the α-amylase is reduced to 4.8% after one hour, while there still remains 25% of the β-amylase. At pH 4.5 and 60°C., the position is reversed. Of the α-amylase there is still 41% remaining. Under the same conditions, the β-amylase is 100% destroyed. As can be seen, the relationship is quite complicated. In addition, β-amylase is negatively influenced by calcium ions. Table IX serves to illustrate this relationship.

It is a recognized fact that calcium ions protect α-amylase at elevated temperatures, as the remaining liquefaction activity after 30-minute heat treatment shows. But the dextrinization activities, as compared with the liquefaction values, have become considerably reduced, which leads back to the fact that the dextrinization value is partly due to the β-amylase content of the malt extract (see Fig. 15). If pure malt-α-amylase is given identical treatment, the dextrinization and liquefaction activities are of the same order of magnitude. If we do not work at too extreme temperatures (not over 50°C., for example), and if the pH is not too low (not below 4.5), then malt preparations of equal dextrinization power are of equal value, no matter whether they possess high α-amylase content with comparatively low β-amylase content, or relatively high β-amylase content with low α-amylase content.

(B) COMPARISON—As the relationship between saccharification, liquefaction and dextrinization varies with amylases of different origin *(25)*, as has been stated at the outset, at the best only one method of comparison of different amylases with one another is applicable. If two or more methods were possible they would have to give parallel results. This is however not the case. Redfern and Landis *(24)* show liquefaction-viscosity curves for various α-amylases, from which it must be

TABLE VII

Malt Solutions with Varying Proportions of α- and β-Amylase but Having Equal Dextrinization Power

Bath No.	*Saccharification Constituent α-Amylase %*	*Saccharification Constituent β-Amylase %*	*Amylase units determined*		
			Liquefaction (Liquefons)	*Dextrinization*	*Saccharification*
1	100	0	930	93	10.2
2	35.1	64.9	573	93	18.0
3	21.2	78.8	430	93	21.9
4	11.9	88.1	310	93	29.1
5	8.3	91.7	267	93	35.4
6	6.3	94.7	251	93	43.5
7	5.1	94.9	243	93	52.2
8	4.1	95.9	236	93	60.9

TABLE VIII

Influence of pH and Temperature on α- and β-Amylase (Residual Activity in %)

Treatment	*pH 4.0 50°C.*		*pH 4.5 60°C.*	
	α-Amylase	*β-Amylase*	*α-Amylase*	*β-Amylase*
without heating	100	100	100	100
at temp. for 10 min.	21.1	68	79	32
20 min.	7.5	53	63	13
30 min.	6.4	42	59	3.8
60 min.	4.8	25	41	0.0

TABLE IX
Remaining Dextrinization and Liquefaction Activity after Partial Heat Inactivation of Malt Extract

Heat treatment for 30 min.	*Solution*	*Dextrinisation*	*Liquefaction (α-Amylase)* %
untreated	H_2O	100	100
untreated	$CaCl_2$	100	100
50°C.	H_2O	95.0	100
50°C.	$CaCl_2$	95.0	100
60°C.	H_2O	57.5	80
60°C.	$CaCl_2$	46.0	100
70°C.	H_2O	4.8	2
70°C.	$CaCl_2$	34.5	78

concluded that the intercomparison of α-amylases of heterogeneous origin is not possible. Myrback *(42)* found, for example, that malt α-amylase is fundamentally different to the other α-amylases, inasmuch as besides maltose, it also liberates glucose (as much as 20%), which is not the case with other amylases. From this it could be concluded that the formation of glucose is not attributable to the decomposition of maltose, but that glucose is primarily split off from the starch.

The supposition is obvious that various types of amylase having equal dextrinization power have the same desizing properties. By means of the following desizing test, we have compared pancreatic, bacterial and malt amylases having equal dextrinization power. It appears, however, that the desizing results are not in harmony with the dextrinization effects. We have come to the conclusion that analytical methods for intercomparison of different types of amylase are rather valueless. Only a practical desizing test can show the value of different preparations.

8. The Desizing Test

Kehren *(28)* has worked out a laboratory scale desizing test, which we have used for our research work in a slightly altered form. The procedure is as follows:

For every liquor to be tested, 6 samples of regular sized cloth are prepared 5 x 10 cm. in size. The material is rolled up as evenly as possible lengthwise so that it will fit comfortably into a 16/160 mm. test tube. Into each of the six test tubes 15 cc. of the desizing liquor is poured and the samples inserted. Each tube is shaken as thoroughly and evenly as possible and placed in a water bath at the desired temperature. A wire basket with suitable rack is used for the purpose. After 120 minutes the first three samples are taken out and immersed in a 1% hydrochloric acid at 80°C. for 30 seconds. They are then washed with cold water. After another 120 minutes the next three samples of the series are taken out and treated in the same way. In the meantime, an iodine solution of the following composition has been prepared: 1 gram of iodine is dissolved in a solution of 10 grams of KI in 40 cc. water. After solution is complete this is made up to 1000 cc.

Into this solution the squeezed out samples are plunged, three at a time. After 15 seconds they are removed from the solution and squeezed out.

From the depth of the blue coloration it is possible to evaluate the various liquors. The composition of the liquor, also the other conditions (temperature, time), can be varied at will. It goes without saying that the desizing test should be carried out under the exact conditions prescribed by the manufacturer of the desizing agent as regards temperature, pH, salt addition, etc. Furthermore, the desizing test should be performed under conditions as close as possible to those employed in practical application.

In this way it should be possible to find that product which will best fulfill the given requirements. As a matter of fact, the practical man judges individual preparations very differently. This arises for the most part, from the differences in types of machinery and processes. It makes a difference how the desizing is done, whether on the jig, on the rope washer or in the wooden tub, whether it is done by the method of "laying over" or by a rapid method. Pretreatment of the goods (wetting out or steeping) is of great importance.

Summary

The questions in connection with the enzymatical desizing of starch-sized textiles are discussed, based on our present knowledge on starch and starch-splitting enzymes. Commercial desizing preparations contain either pancreatic, bacterial or malt amylases. The particular properties of the three amylases are described. Bacterial and pancreas amylases are pure α-amylases (dextrinogen amylase, liquefying amylase) whereas malt contains α-and β-amylase (saccharinogen amylase). The term "temperature optimum" is critically viewed. It is impossible to state absolutely a temperature optimum, since it is dependent on the reaction time. Generally we can say: the higher the temperature the shorter the reaction time (desizing time).

Three methods for measuring amylase activities are customary: liquefaction, saccharification and dextrinization. Liquefaction procedure measures only α-amylases, saccharification measures both α- and β-amylases and every one independent of the other. Dextrinization measures a combination effect of α- and β-amylase and likewise α-amylase alone. In presence of sufficient β-amylase the dextrinization effect of α-amylase is up to 5-fold as effective as without β-amylase, but β-amylase alone has no dextrinization effect, and thus no desizing power. It is pointed out that for standardization purposes for producers of bacterial and pancreatic amylases, each analytical method is practicable and for standardization of malt amylase only dextrinization procedure is suitable. For determining the effective desizing value of some preparations all analytical methods are worthless. Only a practical desizing test allows one to pass judgment on the true value of any desizing preparation. A desizing test is described in this paper.

Even when the sources of the amylases are identical, the desizing value will not agree with the analytical values. In our laboratory we have prepared pancreatic preparations for desizing purposes with the same analytical values which differ in desizing power up to 3 times the analytical values. "Fermasol G" (Swiss Ferment Company Ltd. Basle), for instance, has lower amylase content than "Fermasol F" but the desizing power of "Fermasol G" is greater than that of "Fermasol F."

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(Concluded on Page 202)

• PATENT DIGEST •

PAUL WENGRAF

Pigment Printing—Oil-in-Water Emulsions—Caseinates in the Aqueous Phase D, 2, 07

Brit. P. 628,882
(Ciba, Ltd., Sept. 7, 1949)

This specification relating to pigment printing emulsions mentions Ciba's Brit. P. 544,157 which describes an oil-in-water emulsion containing, in the aqueous phase, an alkaline caseinate solution (up to 12% of the weight of the paste), formaldehyde, and a resin-forming base (urea, thiourea, guanidine or the like). The oily phase consists of an organic, water immiscible liquid which boils between 100-250°C. These emulsions are said to have the drawback of containing large quantities of free formaldehyde, developing an unpleasant odor. The present invention offers a modification of this method by replacing the formaldehyde condensates (i.e., methylol urea or the like) by water-soluble ether-type compounds of these condensates. Examples include reaction products of urea and formaldehyde plus a water-miscible lower alcohol such as methanol, ethanol, glycol, glycerol or isopropanol. These condensates have the advantage of liberating formaldehyde at a very slow rate, thereby avoiding premature hardening of the casein which is insolubilized at 100°C. Generally, casein is first dissolved in a basic reagent (for instance, ammonia, caustic soda or triethanolamine). This casein solution is particularly suitable for preparing oil-in-water emulsion. An organic liquid is dispersed and homogenized therein (e.g., chlorobenzene, white spirit or ligroin) optionally containing oil-soluble resins or chlorinated rubber. The alkylated formaldehyde-amine resin is added. The paste remains unchanged for a long time and hardens, after printing, in a curing process only. Lustrous fabrics printed with this paste show either white or colored dulling effects according to the pigment incorporated into this paste.

Reference is made to Brit. P. 592,841 (American Cyanamid) of Oct. 1st, 1947 (REPORTER 1948, 697). The aqueous phase here contains an etherified methylolurea solution and, as a protective agent, a hydrophilic colloid such as a water-soluble methyl cellulose. While in the Cyanamid patent small catalytical amounts of phosphoric acid or the like have to be added, the present specification emphasizes that no catalyst whatsoever has to be used (page 2, lines 10-15).

The "Orema" pigment dyeing and printing pastes, manufactured by Ciba are covered by Brit. P. 544,157 (see above) and probably by the present patent too. (Cf. *Textil-Rundschau,* April 1947, p. 131, Editor's note).

Shrinkproofing Wool, Organosilicon Compounds Used A, 2, 04

Brit. P. 629,329
(Wolsey Ltd., Alexander-Earland, Sept. 16, 1949)

Shrinkproofing wool has formerly been attempted by different chemical treatments such as chlorine or permanganate (cf. REPORTER 1949, 522, 1948, 383, etc.) by splitting the -S-S- cross-linkages and blocking the residual chains by alkylation (REPORTER 1948, 445). Mechanical treatments by the action of ultrasonic waves (REPORTER 1949, 585) should likewise be mentioned. The present invention discovered a new way, suggesting a treatment with organosilanes which are subsequently transformed into insoluble compounds by hydrolysis: a dihalogen-dialkyl (or diaryl) silane (for example, diethyl silicon dichloride, $(C_2H_5)_2$ Si C_{2}, is applied to a wool fiber of a moisture content of 10-30% in admixture with an appropriate solvent such as silicium tetrachloride at about 50°C. After 10-30 min. immersion, the textile material is removed from the solution and treated with water while being agitated and squeezed repeatedly to insure good penetration. After drying, a resin is deposited on the fiber, imparting good shrinkage and wear resistance. An amount of 2% resin content, calculated from the material's weight, is indicated as a maximum; a higher percentage (5%) of resin makes the fibers rough and acts as an abrasive. It has been observed that no substantial wetting of the fibers occurs in the water-free medium; therefore, the resin is preponderantly deposited on the fiber's surface with the effect of masking the scales of the wool. According to an example, a solution of 2 l. carbon tetrachloride containing 0.4% $SiCl_4$ and 1% diethyl-dichlorosilane was very suitable for shrinkproofing 100 gm. wool fibers.

Reference is made to known waterproofing processes with organosilicon compounds (cf. U. S. Pat. 2,415,017, REPORTER 1947, 396). These methods have, however, mostly been applied to cellulosic fibers; shrinkproofing wool with organosilicon compounds has not yet been proposed up to now as far as can be seen.

Shrinkproofing Wool—Waltersoluble Precondensates; Aftertreating with Acids in Two Curing Steps A, 2, 04

U. S. Pat. 2,485,250
(Wolsey Ltd., Alexander-Bell, Oct. 18, 1949).

The inventors are aware that a shrinkproofing method of wool has been suggested, comprising an impregnation with a formaldehyde-urea solution of low molecular size and followed by complete condensation, by passing the fabrics through an acid vapor filled ager. In contrast hereto, the present process consists of immersing wool fabrics in a neutral solution of methylolurea (formed by condensing equimolecular amounts of urea and formaldehyde in neutral solution for some hours), squeezing, curing at 80-135°C. (preferably not over 110°C.), treating thereafter with a strong mineral acid, squeezing, drying and curing again at 90-135°C. (110°C.). The quantity of resin deposited on the fiber is about 10-15% of the fiber's weight. The mineral acid used is preferably sulfuric acid of N or 2N concentration. Very satisfactory results are said to be obtained with regard to shrinkproofing effect as well as to resistance to abrasion. It is assumed that after the first curing process, neutral monomethylolurea combines with the reactive hydrogen of the amino groups contained in wool without undergoing polymerization while nonreacted methylol urea condensate polymerizes in the second acid application and curing processes with the substance fixed within the fiber. It is emphasized that the new method gives a soft handle in contradistinction to the former one-phase impregnation process wherein fibers are prepared with neutral condensates and cured after an acid treatment only. The same is true for methods using potentially acid solutions (ammonium chloride), liberating acid in the curing process. According to one of the examples, knitted wool is prewetted and passed through a concentrated solution of 30% formaldehyde and 60% urea, neutralized by ammonia. After being dried and cured for 2 minutes at 110°C., the fabric is led through 2 N sulfuric acid, rinsed to remove excess acid, dried and heated for 2 min. at 100°C. The goods thus treated had an area shrinkage of 5.2%, the nontreated fabrics 28%.

References cited by the Patent Office, among others:

U. S. Pat. 2,395,791, 1946 (Cluett Peabody): stabilizing wool by combined treatment with alcoholic lye and by a resin condensate, both of these operations being in themselves insufficient to produce stabilization.

U. S. Pat. 2,395,724, 1946 (Tootal Broadhurst): treating wool-containing mixed material first with precondensates of the amino type + diphosphate, drying, curing, chlorinating and removing the chlorine by acid rinsing. The effect is said to be one of reduced shrinkage as well as decreased felting.

U. S. Pat. 2,219,375, 1940 (Rohm & Haas): creaseproofing effects are obtained first by treating with additional products of formaldehyde and urea in the presence of an ammonium salt of a strong acid (as a catalyst), then by drying and heat curing.

U. S. Pat. 2,123,152, 1938 (Dreyfus, Rivat): impregnating fabrics with precondensates of the type mentioned above, curing and dyeing with basic dyes.

U. S. Pat. 2,093,651, 1937 (Widmer & Pierce): use of formaldehyde-urea condensates as fixing agents for pigment, acid azo and direct dyes.

Reference: the present patent has many analogies with other shrinkproofing methods in that urea-formaldehyde condensates are applied. The main innovation consists of curing in two different steps, one of them carried out after impregnation, the other after the acid fixation. The authors observed that the main progress regarding shrinkage and abrasion resistance and soft handle is due to this specific modification.

Sample Cutter for Textile Fiber Goods D, 6

U. S. Pat. 2,483,493
(H. Hutten. Oct. 4, 1949)

This patent describes a sample cutter which works on movable goods (particularly on fabrics) during the dyeing operation without stopping the movement of the material, thereby avoiding irregular dyeing results. The invention is best understood by referring to the accompanying drawings. Fig. 1 shows the entire device marked by dotted and full lines to indicate two positions of the apparatus. The cutter head consists of a frame or sheath (9) comprising an outer and an inner portion (10 and 11). Two levers (18 and 22) are connected with (10) and (11) respectively. The outer head is made up of cutters, each on one side of the frame consisting of a fixed, toothed comb (31) which co-operates with a reciprocable cutter bar (32). The latter is provided with pins (34)—see Fig. 1 and 2—movable in slots (16) as shown in detail in Fig. 3. With a down movement of the pins (34), the combs move outwardly beyond the rim portion of the frame to connect the tool to the moving material. In the initial—normal—position, marked by full lines in Fig. 1 the cutter head is within the confines of the sheath (9). The second step consists of completely shearing the sample off the fabric by further projecting the cutter bar (13) simultaneously with the cutting teeth. Eventually this operation is completed by the movement of a pick-up member, consisting of a resilient arm (35) which is provided with a hook (36) that can be engaged by the downward movement of the plunger (38). This device is obviously apt to cut the sample without interrupting the dyeing operation, thus avoiding loss of working time and irregular dyeing results caused by temporary stoppage of the cloth in the dyebath.

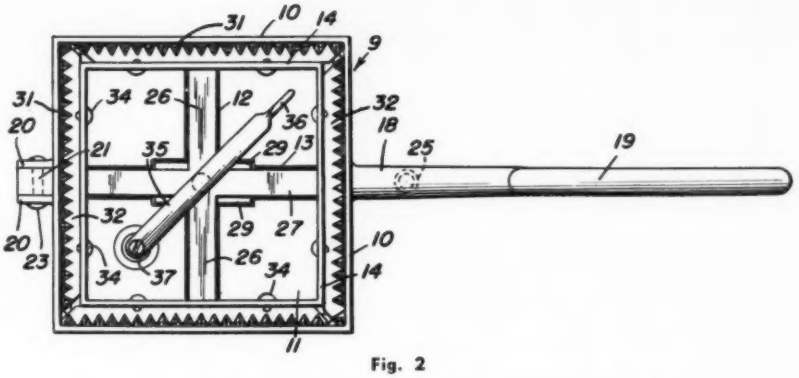

Fig. 2

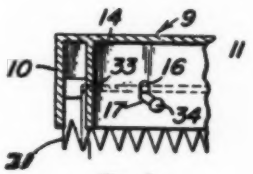

Fig. 3

References cited by the Patent Office:

U. S. Pat. 1,385,481 (Williams): a fender for bars, rods and wires, comprising a tubular body with a pair of concave seats on its opposite sides. This is especially intended for bending lingual bars in the dentistry technique. Cf. *Reporter* 1949, 287, March 21, 1949.

Vat Dyeing, Pad Steam Process and Apparatus C, 4, 02

U. S. Pat. 2,487,197
(Du Pont, Stott-Shimp, Nov. 8, 1949)

The object of the present patent is to dye textile fibers in a pad dyeing process, to develop the dyes continuously avoiding surface oxidation, and carry out the operation without separate handling. The results are claimed to be superior in penetration, fastness and rubbing to those of previous dyeing methods. The process consists of pigment padding of the vat dyestuff, suspending in an aqueous medium, subsequent passing of the cloth through a reducing solution at a temperature below that at which reduction takes place and then immediately leading the goods through an air-free chamber of the Mather-Platt-type heated to 212°F. or above. It is here that reduc-

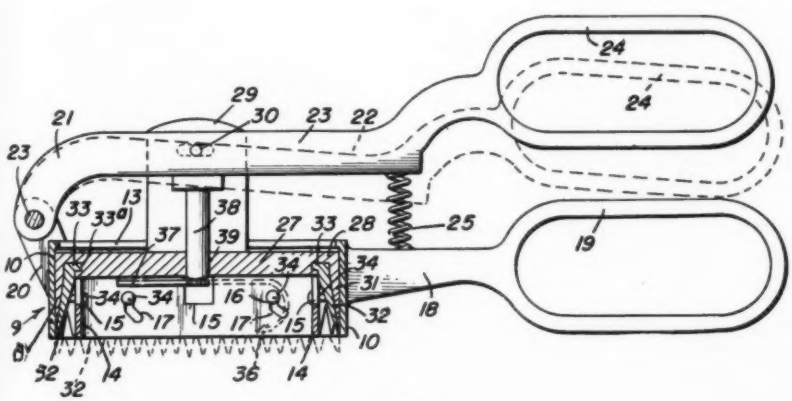

Fig. 1

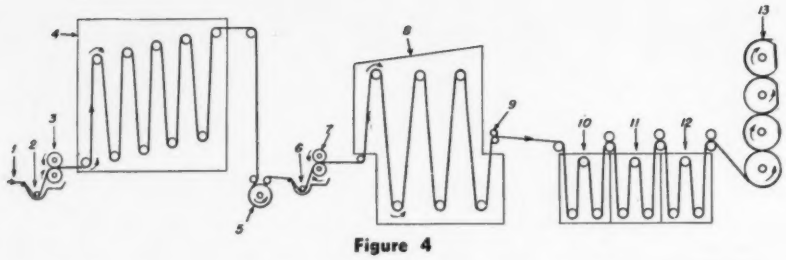

Figure 4

tion and fixation is effected. Thereupon the re-oxidation of the vat dyes is carried out as usual. The process will best be understood by examining Figure 4. The pigment padded fabric (1) is dried in chamber (4), cooled by can (5), impregnated in the padder (6) with the alkaline reducing agent at a low temperature (as mentioned above) and run through the air-free ager (8). The tanks (10), (11) and (12) contain the oxidizing agent, a soap solution and rinsing water respectively. The chemical pad contained in (6) should be squeezed to a 100% pick-up to insure complete development in the steamer. A higher moisture content is recommended in using difficultly soluble dyestuff types or in handling tighter woven fabrics. According to an example, a suspension of Ponsol Jade Green Paste (11.6%) is padded and mixed with an alkyl-naphthalene sulfonate ("Alkanol B"). The chemical pad consists of equal parts of sodium hydrosulfite, caustic soda and sodium chloride. Sodium dichromate or any of the known oxydizing agents may be used.

References cited by the Patent Office, among others:

U. S. Pat. 2,204,439, 1940: dyeing apparatus consisting of two U-shaped tanks especially for vat dyeing, one for the padding, the other one for the developing solution. These can be used alternately by driving the goods from one solution into the other.

U. S. Pat. 2,164,930, 1939 (Du Pont): general vat dyeing methods such as pigment pad dyeing, reduced vat dyeing, etc., with the specific object of using formamidine sulfinic acid as a reducing agent.

U. S. Pat. 2,151,363, 1939 (Wedler): principally the same construction as described in U. S. P. 2,204,839 (see above), comprising a double jig for alternately treating cloth in pigment pad dyeing processes.

U. S. P. 2,089,920, 1937 (General Aniline): the "Electrofixer" used for rapidly fixing vat pigments, applied in mixture with hydrosulfite.

U. S. Pat. 2,607,926, 1937 (National Aniline): lower alkyl sulfates (sodium-butyl sulfates) as vat dye auxiliaries and pasting agents.

Other references:

G. P. 574,939 (Pfeffer—mentioned in digest of G. P. 748,974 REPORTER 1946, 459): the "Colloresin" ager: vat dyes applied in pigment form, thickened with alkylcellulose, reduced in alkaline hydrosulfite and developed in a steam chamber.

Water Repellent Fabrics, Esters of Nitro-Alcohols G 2, 0 2

U. S. Pat. 2,488,650
(Commercial Solvents Corp., Tindall, Nov. 22, 1949)

The patent specification refers to water repellent finishes obtained by insolubilizing the finishes by baking or ironing processes. It is assumed that the impregnating compound is caused to flow around the individual fibers and to seal off the capillary openings under the influence of heat. It has been observed that higher acid esters of aliphatic nitro alcohols impart water repellency in a process somewhat analogous to the Zelan method. Typical compounds used in this reaction are: nitro-butyl stearate, 2-nitro-2-methyl-1-propyl-stearate: $CH_3C(NO_2)(CH_3)CO.CO_{17}H_{35}$, and the like. These are formed by reacting the lower nitro alcohol with the higher fatty acid or an anhydride thereof under the influence of an acid catalyst such as sulfuric, hydrochloric or toluene sulfonic acid at 50-90°C. The initial material, i.e., the lower nitro alcohols, are prepared according to standard methods described, for instance, in U. S. Pat. 2,135,144 (Vanderbilt). This covers the reacting of a nitro paraffin with an aldehyde. Cloth is immersed in an organic solvent (benzene) solution of the ester, dried at room temperature and baked for 10 min. at 150-160°C. The spray ratings according to the standard spray test (A.A.T.C.C.) were: after baking and before washing, 70, after one washing operation, 70, and after a second washing, 50.

References cited by the Patent Office, among others:

U. S. Pat. 2,291,021, 1942 (Rohm & Haas): reducing water adsorption of cellulosic textiles by a treatment with aldehydo-quaternary ammonium compounds which form stable compounds with cellulose by heating.

U. S. Pat. 2,233,607, 1941 (Purdue Research): esters of nitro alcohols, e.g., methyl nitro butyl acetate, are described as pleasant smelling liquids which are useful as intermediates.

In recent time halogenated nitro alcohols condensed with melamine have been suggested as resin modifying agents for various finishing purposes (U. S. Pat. 2,457,404-06 of Monsanto Chemical Co.)

Water Repellent Fabrics—Quaternary Compounds Derived from Higher Imides G, 2, 0 2

U. S. Pat. 2,489,473

(Sun Chemical Corp., Zerner, Pollak, Nov. 29, 1949)

New water-soluble products, useful for imparting durable water repellency to fabrics, are prepared by synthesis of hitherto unknown intermediary compounds which are subsequently transformed into quaternary ammonium derivatives. These intermediary substances are obtained by heating higher amides—e.g., stearamide, to a high temperature (300-350°C.)—whereby the amide is split into free acid nitrile evolving ammonia according to the equation:

$$2\ C_{17}H_{35}CO.NH_2 \rightarrow C_{17}H_{35}COOH + C_{17}H_{35}CN + NH_3$$

With further heating the distearimide results by molecular re-arrangement: $(C_{17}H_{35}CO)_2:NH$. This product is purified by vacuum distillation and has been finally identified by analysis. Further steps consist of chloromethylating the substance and reacting it with pyridine. The final product is a pyridinium compound, somewhat similar to the known Zelan compounds but differing therefrom by a content of two higher fatty acid groups linked to one pyridinium radicle. The finishing process is carried out by dipping cellulosic cloth in an aqueous solution of the product, adding sodium acetate (in treating wool, sodium acetate has to be omitted), then squeezing out, baking or simply ironing at elevated temperatures. Spray rating tests of the treated fabrics were found to be 100; after three launderings this figure dropped to 90, while water repellency remained practically unchanged after three dry-cleaning operations.

References cited by the Patent Office, among others:

U. S. Pat. 2,388,132/1945 (Union Oil of California): preparation of corrosion resisting mineral oils (especially turbine oils) containing higher molecular imido-esters and amidines.

U. S. Pat. 2,365,813/1945 (Monsanto Chemical Co.): impregnation of paper with a diamino methane, the two nitrogens being substituted by higher carboxylic groups.

U. S. Pat. 2,125,901/1938 (Imperial Chemical Ind.): improving the water-fast-

(Continued on Page 201)

Proceedings of the
American Association of Textile Chemists and Colorists

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MARCH 20, 1950

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A STUDY OF SOME OF THE FACTORS INVOLVED IN MEASURING FLAMMABILITY OF CONSUMER TEXTILES

EDWIN P. JOHNSTONE*
A.A.T.C.C. Research Associate

This report summarizes briefly some general features of an investigation sponsored by and with the close cooperation of the A.A.T.C.C. Committee on Flammability of Consumer Textiles, Dr. H. E. Hager, Chairman.

The interest and generous financial support of members of the cotton industry, rayon producers, and retailers are of great importance in forwarding the development of a satisfactory and useful test method.

INTEREST in methods of determining the rate of burning and the flammability hazard of textile materials used for clothing has been increased by occasional loss of life through accidental ignition of clothing. Cases have been reported in which clothing material burned with extreme rapidity and with the formation of voluminous flames of such intensity that the wearer suffered fatal burns.

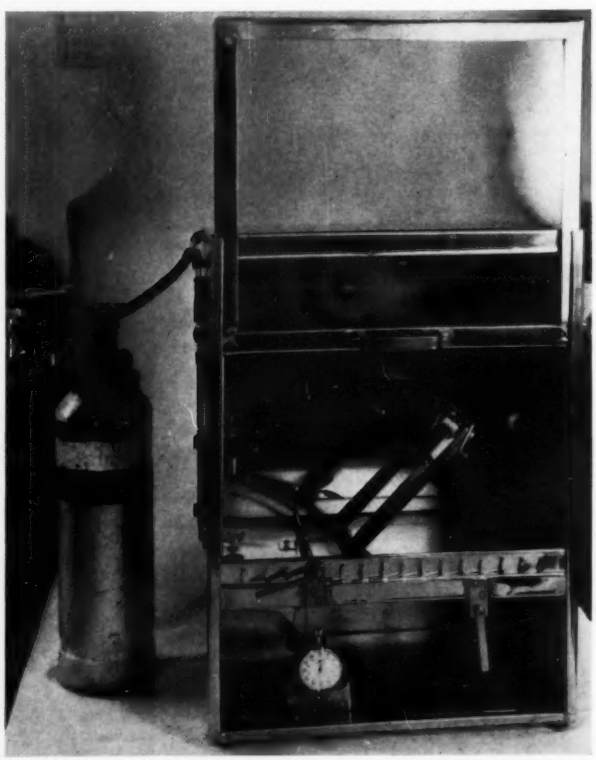
Numerous methods designed to measure the relative rate of burning of textile materials have been proposed from time to time by those groups interested in protecting the public from this hazard. The method suggested by the Flammability Committee of the American Association of Textile Chemists and Colorists has received considerable attention and has been offered to the industry as a guide in the production of clothing fabrics that will have a minimum of flammability hazard.

This method utilizes an instrument designed to measure the rate of travel of a flame over a textile fabric supported at an angle of forty-five degrees. The test sample, after suitable preparation, is ignited by a standard flame during a period of one second, and the time of burning over a distance of five inches is recorded mechanically. In a series of tests conducted by the Technical Subcommittee on TS-4350 of the Commodity Standard Division of the National Bureau of Standards it was found that this method may be used to measure the rate of burning of fabrics constructed with a long pile or nap, and that the method was also satisfactory with a reasonable degree of accuracy for the measurement of flammability of flat woven fabrics, such as sheers and nets. Difficulty in obtaining reproducibility of test results between laboratories participating in these tests, however, and the scatter between rate-of-burning test results obtained on individual test samples were, in some instances, of sufficient magnitude to cause the Flammability Committee of the A.A.T.C.C. to investigate further the possible means of improving the accuracy of the test method.

FACTORS IN FLAMMABILITY HAZARD.—In addition to a precise measurement of the rate of burning of a textile fabric, many other factors are necessary for any interpretation of flammability hazard, including the following:

(a) ease of ignition of the material,
(b) volume and temperature of flame and of noxious vapors evolved during combustion,
(c) total heat produced,
(d) ignition through to the back of the fabric resulting in actual contact of the flame with the skin surface,
(e) ignition of adjacent layers of fabric, i.e., undergarments,
(f) ease of extinguishing the burning clothing material.

Since all cellulosic materials and most other fibers are combustible in various degrees, certain combinations of the above factors could result in a fatal burning. With respect to ease of ignition, the proposed A.A.T.C.C. method specifies impingement of a standard butane flame ⅜ inches in length against the fabric surface for a period of one second. It has been found that a plain woven cotton fabric (print cloth) generally does not ignite in less than three seconds, while a material such as a cotton or rayon sheer or a heavily napped or long-pile fabric usually



A.A.T.C.C. Flammability Tester

* A.A.T.C.C. Research Laboratory, Lowell, Mass.

ignites easily in a one-second ignition period.

Measurement of the volume of flame produced and the actual flame temperatures reached, as well as the total heat produced, have been given consideration, but the initial results obtained will not be presented in this report. The type and volume of noxious gases have been reported by other investigators and were not included within the scope of the present investigation. Attempts have been made to obtain simultaneous determinations of the rapid secondary flash-over and the slower primary burning due to ignition through to the back of napped, pile, or tufted fabrics by a modification of the present A.A.T.C.C. Flammability Tester.

Test Method

Modification of the A.A.T.C.C. test instrument at the Central Research Laboratories of the Association included redesign of the means for supporting the fabric sample and elimination of the fabric-supporting wires of the present tester. The wires had been found to dissipate the heat of burning so that the time of burning was lengthened. A sample holder was developed which permitted mounting of the fabric sample prior to combing, brushing, drying, or cooling, thereby reducing handling of the test sample. The test instrument was modified further, for research purposes only, by the installation of an electric timing system which allowed precise measurement of extremely rapid burning times of the order of less than one second. Emphasis in the present investigation was placed upon a study of the mechanism of *secondary burning* (flash fire), the combustion or flaming of the nap, pile, or tufting of textile fabrics as contrasted with *primary burning*, which describes the burning of an unnapped plain fabric or the base fabric of a napped, pile, or tufted fabric. A study of methods for the preparation of a test sample prior to determination of rate of burning was carried out, and an analysis of the reproducibility of test results was undertaken.

Tests were performed in accordance with A.A.T.C.C. Tentative Test Method 33-46 for Evaluation of Textiles for Flammability *(Technical Manual and Year Book of the A.A.T.C.C., 1949)*. All samples for tests were mounted in the new fabric holder, dried in a horizontal position in the oven for 30 minutes at 221°F., and then cooled in a desiccator over calcium chloride for 15 minutes before determination of rate of burning. The samples were placed in the A.A.T.C.C. Flammability Tester and were subjected to the flame within 45 seconds of removal from the desiccator. At least ten samples were run successively for each test, and the mean and minimum time were determined.

Since it had become apparent that a satisfactory test method should include a means whereby the potential flammability hazard of certain types of napped, pile, or tufted fabric could be demonstrated, the investigation included a number of tests utilizing means other than the A.A.T.C.C. combing device to raise the surface fibers. Various brushing devices with nylon bristles of different lengths, stiffness, thickness, and spacing of bristle tufts were tested. The effect of raising the surface fibers of the fabric in an electrostatic field was examined. The use of steam and brushing was investigated at the suggestion of the California State Fire Marshal's Office. It should be noted in this connection that it is standard practice in dry-cleaning establishments to steam and to brush fabric surfaces with a stiff whiskbroom to restore napped or pile fabrics to a normal condition.

In addition to a means for establishing the potential flammability hazard of certain napped, pile, or tufted fabrics, a means was sought whereby the least hazardous condition of the fabric could be determined as well as the *as received* and most hazardous conditions, thus providing information covering the entire range of susceptibility of a given fabric. A number of trials were made in which the surface fibers were pressed on a General Electric Flatbed Press or between weighted plates in a laboratory oven.

Test Results

A. MODIFICATION OF THE A.A.T.C.C. FLAMMABILITY INCLINED TESTER.—Installation of a removable sample holder was found to facilitate insertion of the fabric test strip into the cabinet with a minimum of handling of the test fabric and a minimum of exposure to room humidity after removal from the desiccator. It had been shown previously in these laboratories that the pile or nap absorbs moisture at a much faster rate than the body of the cloth, and this moisture introduces an appreciable error. Elimination of the wires supporting the fabric test strip was found to result in burning times for a number of different fabrics lower than those obtained when the fabric test strip was supported by wires spaced ¼" apart. The average burning time for ten samples was approximately one or two seconds lower in most instances when the fabric was not supported by wires.

Electric timing permitted precise measurement of extremely rapid secondary flashes over the surface of the test strip, which in some instances were of less than one-second duration, and many research data were compiled on the secondary burning characteristics of napped or pile fabrics. The tests showed that the mechanical timing device of the present A.A.T.C.C. Flammability Tester functioned with sufficient accuracy for practical purposes.

B. REPRODUCIBILITY OF THE TEST METHOD.—Since it had been found in previous interlaboratory testing programs that precision determination of fabric flammability was not possible on account of inherent variations in fabric construction and uncontrollable differences in the manipulation of the test instrument resulting in significant differences in results obtained by the several laboratories on napped or brushed types of cotton and rayon fabrics, a series of tests was carried out to determine the cause of these differences. It was found that test results obtained on various napped or brushed-type fabrics were reproducible within fairly narrow limits if the test fabric was maintained in a constant condition with respect to the surface fibers. Slight disturbance of the surface fibers, either by brushing to raise the fibers or by pressing to lower the fibers, resulted in a significant difference in test results, and extreme care is necessary in handling the fabric test strips to insure against disturbance of the surface fibers.

A roll of brushed-type knit-rayon pile fabric was specially prepared and sheared to three different nap lengths. Tests were made to determine the reproducibility of the flammability test on the modified tester. A series of tests was made on the fabric as received in roll form from the mill, the fabric being tested in its received condition without special mechanical preparation of the nap before testing. Figure 1 shows the rate of burning of 100 individual samples of this fabric. The individual tests were found to fall in the following ranges:

Burning Time Seconds	*Percent*
6 to 7	6
7 to 8	6
8 to 9	37
9 to 10	31
10 to 11	18
11 to 12	1
over 12	1
	100

It will be noted that 87% of the tests on this rayon fabric with brushed nap of intermediate length fell within the limits of 8 to 11 seconds, but 12% approached the six-second limit. Test series A, B, and C of Figure 1 indicate the effect upon the test results of the weight of the roll of fabric pressing on the brushed nap, samples in A series having been taken from the top outside layer of

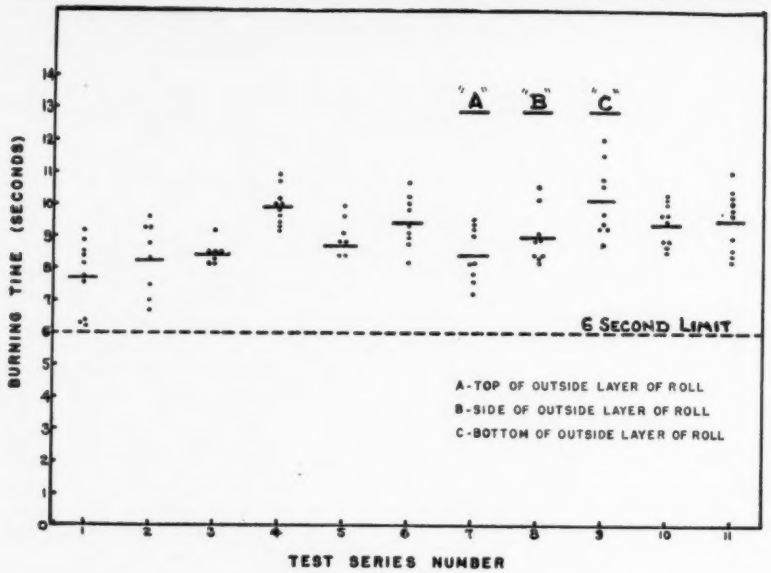


Figure 1

Reproducibility of Tests On the Modified A.A.T.C.C. Flammability Tester (Burning Times of 100 Individual Test Samples of Knit Brushed Type Rayon Fabric Selected At Random From the Roll As Received From the Mill)

the roll, samples in the B series from the side of the roll, and samples in the C series from the bottom of the roll. The last samples had been subjected to the weight of the roll for several days with resultant pressing down of the nap and consequent raising of the average burning time from 8.5 seconds to over 10 seconds. The difference was considered significant with respect to the effect of the condition of the fabric as received on average burning time.

Figure 2 illustrates the significant changes that may be obtained by mechanical alteration of the nap of the brushed-type rayon fabric by severe brushing to raise the surface fibers or by pressing to lower the surface fibers. These changes are analogous to those which might result from actual wear of this fabric as a clothing material. It is apparent that, although this fabric may be classified as nonhazardous in the condition in which it was received from the mill, and particularly so under conditions in actual use as a clothing material where the nap may be pressed down, it possesses inherent characteristics which would make it potentially dangerous under conditions where the nap is roughed up and raised. It is evident that any method adopted for the determination of the rate of burning and the flammability hazard of napped or pile fabrics should include a means of establishing the inherent hazard characteristics of the fabric under all conditions of normal usage.

The brushed-nap type of rayon fabric did not exhibit extremely rapid flash-fire tendencies due to the shortness of the nap. It has been noted that the flash-fire type of burning, which spreads extremely rapidly over the surface of the fabric, results when a sufficient number of long fibers protrude above the mass of closely compacted fiber comprising the nap or pile to support this type of combustion. Removal of these loose fibers from above the napped or pile surface by mechanical means, i.e., pressing or shearing, reduces considerably or eliminates this type of flash burning.

A study was made of the effect of position upon the rate of burning of rapidly traveling flames over the surface of a napped fabric. Additional tests, in which the fabric was ignited at the upper end of the test strip, showed the rate of burning in a downward direction to be less than when the flame traveled in an upward direction.

Figure 3 illustrates the rates of flash burning of a long-nap cotton fabric in the vertical, 45-degree, and horizontal positions. Additional tests made on a fabric with a nap of intermediate length and on a fabric with a short nap resulted in rates

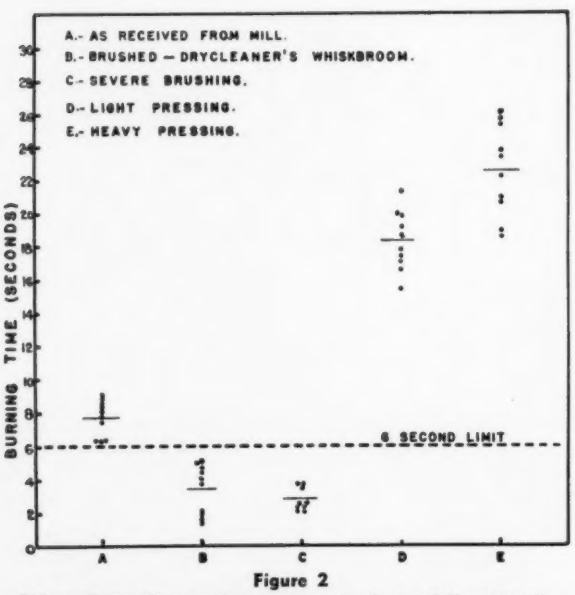


Figure 2

Effect of Brushing or Pressing on the Rate of Burning of a Knit Brushed Type Rayon Fabric As Determined On the Modified A.A.T.C.C. Flammability Tester

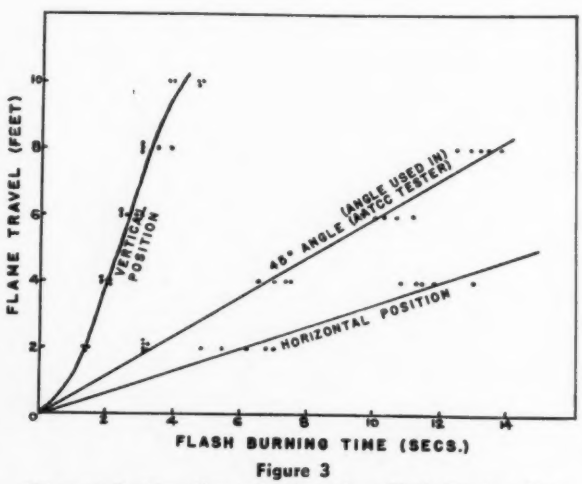


Figure 3

Effect of Position Upon the Secondary Flash Burning Over Various Sample Lengths of a Long Nap Cotton Fabric

of flash burning almost identical with those obtained for the long-nap cotton fabric. It can be concluded that this type of burning is not appreciably influenced by the degree of napping but rather by the long fiber ends protruding above the nap. Any flame acceleration appears to occur within the first second after ignition occurs, and the rate of travel of the flash burning remains constant thereafter, the rate being dependent upon the position of the fabric and the direction of flame travel.

TESTING OF CHENILLES.—In the course of the investigation fourteen different types of chenille fabric were tested on the modified tester. These included many of the common type with respect to spacing of the rows of tufts, compactness of the tufting, and length of tufting. Attempts were made to determine simultaneously the burning rate of the rapidly traveling flame over the top of the tufting and the generally slower burning of the base fabric to obtain a correlation between fabric construction and flammability hazard.

It was found as in a previous series of interlaboratory tests that the chenille type of fabric exhibits a wider variation between test results on individual samples than is generally obtained on plain woven fabrics or napped or pile fabrics with a uniform surface. The chenille types in which the tufting was composed of a densely compacted mass of fiber were found to possess less potential flammability hazard as measured by rate of burning. The open types with tufting spaced widely apart and with less stitches per inch generally were found to ignite easily and to burn rapidly.

The chenille fabrics were tested as received without preliminary mechanical alteration of the fabric surface by combing, brushing or other manipulation. Interpretation of the results was made in accordance with the method suggested in the *A.A.T.C.C. Technical Manual,* which provides that a fabric passes only if the average time for ten tests is six seconds or higher and if no individual time in the series of ten is below five seconds. No definite conclusions have been drawn regarding the relation of the six-second limit with respect to chenille-type fabrics and the relative flammability hazard to be encountered in normal usage of the fabric. Further research is planned to investigate means whereby any potential flammability hazard of certain chenille fabrics may be demonstrated with precision and accuracy. Until such means are developed, it is suggested that considerable care be taken in the handling of the test strip previous to making the rate-of-burning determination and that any interpretation of the relative hazard should be made with discretion.

Acknowledgments

The author takes pleasure in acknowledging the assistance of the A.A.T.C.C. Committee on Flammability of Consumer Textiles, including especially the following: Dr. H. E. Hager, Chairman; Dr. F. Bonnet, representing the Rayon Producers' Group; G. S. Buck, representing the National Cotton Council of America; C. W. Dorn, representing the National Dry Goods Association; C. A. Baker; Edvard N. Young; H. E. Wilde; and C. W. Rulon of the Underwriters' Laboratory.

Summary

Modification of the A.A.T.C.C. Flammability Tester by elimination of sample-supporting wires and design of a new sample holder resulted in increased ease of manipulation and permitted various testing operations to be carried out without further handling of the test strip prior to the rate-of-burning determination. Installation of an electric system of timing allowed for more precise measurement of extremely rapid flash burning in this research. Early models of the A.A.T.C.C. Flammability Tester showed a tendency towards failure of the mechanical timing system, but this has now been corrected by the manufacturer by the installation of counterbalancing weights, and other changes of the leverage system.

The present investigation has demonstrated that variation between individual samples and reproducibility of test results appear to be dependent primarily upon fabric variation and differences in nap or pile of a fabric. Rapid flash burning is related to the number of long fiber ends scattered profusely above the mass of fibers comprising the nap, and appears to travel at a constant rate dependent upon the direction of flame travel and the angle at which the fabric is supported, the flame traveling most rapidly in the vertical position. Reasonably good reproducibility may be obtained, provided all test samples are handled with care to prevent change in the nap or pile surface and to maintain a uniform condition of the individual test strips.

It is suggested that a satisfactory test method should include means of determining the potential flammability hazard under the worst and the best conditions of normal usage to aid in reaching a judicious interpretation of flammability hazard. Since the term *normal usage* of a textile material is one which is difficult to define, investigation of various conditions of usage known to constitute a hazard and development of satisfactory means of creating these conditions should be continued.

Student Section Contest Set for April 1

THE Piedmont Section will hold its first contest between the students of North Carolina State College and Clemson College Student Chapters in its afternoon session of the April 1 meeting at the Robert E. Lee Hotel in Winston-Salem, North Carolina.

The judges for this contest are as follows:

Chief Justice—Dr. Harley A. Jennings, Dan River Mills, Danville, Virginia.

Linton C. Reynolds, Riegel Textile Corporation, Ware Shoals, South Carolina.

Clarence Hooper, Burlington Mills, Burlington, North Carolina.

Members of the Student Section Contest Committee for the Piedmont Section are as follows:

Chairman—A. R. Thompson, Ciba Company, Inc., Charlotte, North Carolina.

W. L. Barker, National Aniline Division, Allied Chemical & Dye Corporation, Charlotte, North Carolina.

S. H. Williams, General Dyestuff Corporation, Charlotte, North Carolina.

The rules for conducting the Student Section Contest Papers to be held annually under the auspices of the Piedmont Section for Student Sections within the jurisdiction of the Piedmont Section follow.

Rules

SUBJECT—Almost any subject may be taken that has originality and practical or scientific value with the single exception that a Section should not use as the body of its paper, work done by some sub-committee of the Research Committee of the A.A.T.C.C. However, this is not intended to prevent a Section from extending or expanding some phase of a general research project. It is merely to prevent any one Section from benefitting from the funds and work done by the Association. The choice of subject will naturally be governed by the system of rating on which the paper is finally judged. This system of rating is given later.

It is important that the subject be chosen early because the time is always found too short to do the subject justice and, in addition, there may be occasional conflicts in which two Sections may choose the same subject. In such a case, the matter is brought to the attention of both Sections so that they may continue on the same subject or not as they prefer.

The title of the paper should not be released for publicity until approved by the Piedmont Section Contest Chairman. All news releases must be handled through the Piedmont Chairman of Publicity.

SPEAKER—Only a member of the

Student Section, in his senior year, may complete in this contest. Graduate students are ineligible.

JUDGES—The Piedmont Section Chairman will appoint a Chief Justice. Each student section shall be permitted to select two senior members of the Association to serve as judges. The two judges selected, by the student section, shall not be members of the teaching staff or otherwise actively engaged by the competing colleges.

The judges chosen by the Section are free to call upon anyone for expert advice as it is unusual for any one man to be competent in all the fields covered by the different papers. The actual rating of the paper, however, is his privilege alone, and a rating sheet will be supplied by the "Chief Justice". The "Chief Justice", who is appointed by the Piedmont Section Chairman, will have a vote only in the case of a tie.

SELECTION OF THE PRIZE WINNERS—The papers of each Section are weighed by the judges on the following basis:

For originality	40 points max.
For practical value..	30 points max.
For scientific value..	20 points max.
For presentation ...	10 points max.
TOTAL	100 points

Each judge will rate each paper independently on this basis and the paper getting the highest total number of points will win the contest. It is obvious that considerable emphasis is put on originality and that the paper must present something new and novel, something that has not been published before. The subject may be one of practical money value to a mill or to consumers, or it may be of scientific or fundamental value which perhaps has little direct economic interest. Some members have felt that no value should be given to the presentation, but the majority feel that the speaker and exhibits, slides, or whatever may be used to make the subject clearer and more interesting, should rate a maximum of 10 points.

The judges must submit a report of their voting to the "Chief Justice" just before the presentation of the Contest Papers. At the close of the Contest the judges then must submit their votes for presentation value.

PRESENTATION OF PAPERS—The final papers selected to be presented before the Piedmont Section will be heard at the regular Spring Meeting of the Piedmont Section. Each student section may choose to hold a preliminary contest at each school thirty days prior to the Spring Meeting of the Piedmont Section to permit all senior students wanting a chance to compete to present their papers before their own student section.

DETAILS ON THE PAPER—The paper is not restricted as to length but its actual presentation will be limited to 20 minutes. This means that a condensed version of the paper, emphasizing its high points, will be given at the meeting while the paper itself may be published in full in the Proceedings in the *American Dyestuff Reporter*. Please note that the paper is the property of the Piedmont Section of the A.A.T.C.C. and is not to be released to any publication other than the *American Dyestuff Reporter*.

Each section will be permitted to have not over three papers eligible for presentation at the Spring Meeting of the Piedmont Section. It is suggested that each student section select the best papers; which, in their judgment, represent the best work of the year. It is suggested that the value of creative thinking and submission of new ideas for improving the processing of textile fibers or fabrics or the controlling of color testing be emphasized.

Five copies of the paper must be furnished to the Student Contest Chairman at least two weeks before the contest. These copies will then be immediately distributed to the judges and the Piedmont Publicity Chairman. The judges need two weeks to read, review, and rate the papers.

The papers should be typewritten, double spaced, using only one side of the sheet and leaving ample margins. One of the copies should be accompanied by the original drawings, in black ink, and glossy photographs. This copy will be used for publication.

EXHIBITS—Any requests for exhibits or display features at the Contest should be made known at the time of submitting the copies of the paper to the Student Section Contest Chairman.

PRIZES—Suitable prizes, to be decided on by the officers of the Piedmont Section and the Student Section Contest Committee, will be awarded those judged to have presented the best papers. In case of a tie for any prize or prizes, duplicate awards will be presented.

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Report, BDTI Student Chapter

THE regular monthly business meeting of the Bradford Durfee Textile Institute Student Chapter was held February 23, 1950.

Reports by the treasurer and other committees were submitted. New committees on publicity, membership and program were appointed.

A lecture followed the business meeting in which Edward Kelly spoke on "Textile Finishing" and Jack Steinberg on "Screen Printing."

Respectfully submitted,
AMERICO B. ALMEIDA, *Sec'y.*

CALENDAR

COUNCIL

Meetings: April 14 (New York) June 9 (Montreal, Que.) Sept. 28-30 (Portsmouth, N. H. Convention) Nov. 17 (New York).

NATIONAL CONVENTIONS

1950: September 28 to 30, Portsmouth, N. H.
1951: October 18 to 20, Statler, New York.
1952: Boston.

MID-WEST SECTION

Meeting: May 6 (Schroeder Hotel, Milwaukee, Wisc.), June 17—Annual Outing—Lake Lawn Lodge, Delavan, Wisc., October 28—Chicago, Ill.

NEW YORK SECTION

Meetings: April 14, May 5 Kohler's Swiss Chalet, Rochelle Park, N. J.), June 16—Outing.

PHILADELPHIA SECTION

Meetings: March 31, May 5 (Kugler's, Philadelphia), June 9 (Annual Outing, Torresdale-Frankford Country Club, Philadelphia), October 13, December 8, January 17, 1951.

PHILADELPHIA TEXTILE INSTITUTE STUDENT CHAPTER

Meetings: March 29, April 26, and May 24.

PIEDMONT SECTION

Meetings: April 1 (Robert E. Lee Hotel, Winston-Salem, N. C.), June 30-July 1 (Ocean Forest Hotel, Myrtle Beach, S. C.), October 28, Charlotte, N. C.

RESEARCH COMMITTEE

Meetings: April 14 (New York) June 9 (Montreal, Que.) Sept. (Portsmouth, N. H., Convention) Nov. 17 (New York).

RHODE ISLAND SECTION

Meetings: March 24 (Providence Engineering Society Hall, Providence, R. I.) April 28 (Providence Engineering Society Hall) May 26 (Johnson's Commodore Room, Providence, R. I.) October 27 (Providence Engineering Society Hall) November 17 (Johnson's Commodore Room)

SOUTH CENTRAL SECTION

Meetings: May 20 (Hotel Patten, Chattanooga, Tenn.) August 18-19 (Summer Outing—Read House—Hotel Patten, Chattanooga Country Club—Chattanooga, Tenn.).

SOUTHEASTERN SECTION

Meetings: May 27 (Columbus, Ga.), Sept 23 (LaGrange, Ga.) Dec. 9 (Atlanta, Ga.).

WESTERN NEW ENGLAND SECTION

Meetings: April 14 (Rapp's Restaurant, Shelton, Conn.) May 26 (Waverly Inn, Cheshire, Conn.) June 23 (Outing at Wallingford, Conn. Country Club).

LIGHT OBSERVATIONS IN ENGLAND*

DR. E. I. STEARNS
Calco Chemical Division of American Cyanamid Co.

ON September 22-24, 1949, I had the pleasure of representing the A.A.T.C.C. at the Symposium on Photochemistry in relation to textiles sponsored by the Society of Dyers and Colourists at Harrowgate, Yorkshire, England. At the symposium dinner on September 23, I was called upon to respond to a toast to "our visitors" and took that opportunity to extend to the Society greetings from the Council of the A.A.T.C.C. and to offer them our cooperation and services in any international program which might develop from the symposium. I said that while the A.A.T.C.C. is not well constituted for highly theoretical research, which is left to the laboratories of individual members, it is interested in improving the durability of textile fabrics and has the ability to spread rapidly throughout American industry any ideas or practices that might lead to that end. I mentioned the forthcoming *Colour Index* as an example of the close cooperation that is possible between our two societies.

One possibility that I had in mind was an internationally acceptable test for fastness to light. In this connection I was particularly interested to learn what was current English practice and to note how different it was from ours, but I found that lack of uniformity is the most striking characteristic of English methods. Burgess, in an article entitled "Fastness to Light of Dyed Textiles," described the method recommended by Imperial Chemical Industries and the different method recommended by the Society of Dyers and Colourists.

In light fastness testing, there are three primary factors which must be defined: (1) the light source, (2) the exposure time, and (3) the "break". With regard to light sources, Cooper and Hawkins in their article "Spectral Characteristics of Light Sources for Fading and Degradation Testing" point out that experimental methods now permit measurement of the characteristics of light sources. If it is assumed that an accelerated fading lamp should have a close similarity to daylight, then there is considerable room for improvement in the enclosed carbon arc that we now use in the Fade-Ometer. However, there seems to be some doubt that the fading lamp must duplicate sunlight exactly because Nordhammer and Gralen in their article, "Testing Color Fastness to Sunlight and Artificial Light" find that the fading caused by a Fade-Ometer is very similar to the fading caused by sunlight. Also Morton in his article, "The Practical Assessment of the Light Fastness of Dyeing" finds that 85% of Fade-Ometer assessments agree within one class with sunlight assessments. Morton concludes that this is an unsatisfactory correlation. However, I think if he tried to correlate several sun tests, such as the fastness results of exposure in the Scandinavian countries with fastness results of exposure in England, he might find that the two sunlight exposures showed no better agreement. I think that his results, 85% agreement within one class, might be used to argue the other way, namely, that the agreement of Fade-Ometer and sunlight is satisfactory.

Measurement of the total amount of light to which a sample has been exposed, which we are doing in this country with a flux-meter on an experimental basis and which we are doing with the National Bureau of Standards test papers on a rather extensive basis, seems to be increasing in popularity. Atherton and Seltzer in their work, "Some Studies on the Fading of Simple Monoazo Dyes" used a photoelectric integrator, and Vickerstaff and Tough in their work, "The Quantitative Measurement of Light Fastness", also used a photoelectric measurement of the integrated amount of light.

The evaluation of a "break" received much discussion but no agreement. The S.D.C. definition is "a real good fade"; the I.C.I. practice is 50% dye destruction independent of hue change. Morton in his paper recommended the evaluation of fastness as the first slight color change, which corresponds closely to American practice, and Vickerstaff and Tough recommended a standard break of ten just perceptible color steps.

There were also a number of papers on the mechanism of fading, which should interest our individual members, and there was considerable work done on photodegradation, which should be of interest to our committee on aging of textiles. Photodegradation can occur in all types of fabrics. While cotton and viscose have been most widely studied, Brear brought out the fact that wool is also affected, and Bamford and Dewar that nylon and acetate are tendered. Three good reviews of photochemical degradation theory were presented by Edgerton, by Bamford and Dewar, and by Landolt.

* Report to Council, 13 Jan., 1950.

Piedmont Section Spring Meeting

THE Spring Meeting of the Piedmont Section will be held at the Robert E. Lee Hotel, Winston-Salem, North Carolina on April 1, 1950.

The Technical Meeting will begin at 3:00 P.M. Saturday, and the student chapter of North Carolina State College will have charge of this program. The first part of this meeting will be devoted to several papers presented by student members from North Carolina State College and Clemson College.

The second part of the afternoon program will feature a paper presented by W. C. Peurifoy of the Hoover Hosiery Mills, Concord, North Carolina, and his subject will be—"Stripping of Nylon with Texton."

The Banquet will begin at 7:00 P.M. with Henry C. Alexander, noted humorist of Charlotte, as speaker. Mr. Alexander has previously spoken to the group and is returning by popular request. The "Maids of Melody", popular girl musical group of Winston-Salem, will furnish the entertainment. The banquet tickets are $4.50 each. The tickets go on sale at 11:00 A.M. Saturday morning in the hotel lobby, and members are again asked to cooperate by buying their tickets before 3:00 P.M.

Hotel reservations should be made direct with the Robert E. Lee Hotel.

Future meetings include the Myrtle Beach Meeting (June 30-July 1) and the Charlotte Meeting (October 28th). Reservations for the Myrtle Beach Meeting will be accepted and confirmed April 1st or after. Room rates will be as follows: Landside double rooms—$20.00, Ocean-side double rooms—$22.00, Corner Rooms—$24.00, and Suites—$30.00. Reservations for suites will be drawn as long as they last.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers, who can obtain further information from the Secretary.

50-5

Education: New Bedford Textile Inst. and N. C. State College, B.S.

Experience: Chemist and Supt., dyeing and printing.

Age 28; married; references; will go anywhere.

3-6, 3-20

50-6

Education: Bradford Durfee Tech. Inst.

Experience: Textile chemist.

Age 26; married; references; will go anywhere.

3-6, 3-20

50-7

Education: University, A.B.; chemistry and writing.

Experience: Chemist, production control and development, rayon and hosiery finishing.

Age 40; married; references; position in New York or Philadelphia area preferred.

3-20, 4-3

CANDIDATES FOR THE OLNEY MEDAL

In the rules for award of the Olney Medal there is provision for receipt of suggestions from members of the Association. Such will be welcomed; but they must be received at a date earlier than that named in the YEAR BOOK, to enable the committee to make its decision and give the Medalist and other speakers at the convention time for their plans.

A nomination received by the Secretary of the Association not later than April 11 will be transmitted to the voting members of the committee, and will be considered in this year's award. It should specify definitely the achievements of the candidate.

NOTICE TO LOCAL SECTIONS

All technical papers and reports of discussions should be sent to the Editor of the Proceedings:

DR. CARL Z. DRAVES
435 Hudson Street,
New York 14, N. Y.

ANNUAL MEETING AND CONVENTION

September 28-29-30, 1950

Wentworth-by-the-Sea

Portsmouth, New Hampshire

Auspices of

Rhode Island Section

COLOUR INDEX

SECOND EDITION

The A.A.T.C.C. *Colour Index* Committee now working on the second production of the *Colour Index* would welcome information on errors which readers have noticed in the first edition.

Please address all communications to:

WILLIAM H. CADY
127 POWER STREET, PROVIDENCE 6, R. I.

Patent Digest—

(Continued from Page 192)

ness of textile material by applying alkoxy methyl pyridinium chloride or other quaternary compounds, heating and decomposing thereby the quaternary substance.

Other references:

B. P. 494,761/1939 (Stolte, Missy) iminoproducts (e.g., stearic acid imides) for water repellent finishes. The present patent is apparently parallel to B. P. 591,832 of Aug. 29, 1947, asigned to Warwick Chemical Co.

Reference is further made to the inventors' studies of water repellency of Zelan-type finishes, published in *Textile Research Journal 1944,* August, p. 242.

Chintz-Effects—Artificial Resins Printed and Glazed D, 1

U. S. Pat. 2,488, 397
(Jos. Bancroft & Sons Co., Hall, Nov. 15, 1949)

The artificial resins used in this process for obtaining chintz-effects are preferably printed, according to the present invention, on sized fabrics in order to impart to the entire material uniform frictional characteristics. This pre-sizing operation can, however, be omitted when the goods already contain some sizing or stiffening substance left therein from a foregoing operation or when very large printed patterns covering more than 80% of the total area are applied. A suitable size consists, for instance, of a dextrine paste to which olein is added as a friction-reducing agent. After drying, a thickened urea-formaldehyde paste containing some sulfonated castor oil is prepared and a catalyst (ammonium thiocyanate) added shortly before printing. The resin concentration is given with about 22.5% of the printing paste. Drying after printing should be effected in such a way that 10% moisture is still left in the fabric. The next step consists of passing the printed goods through a friction glazer. The upper (frictionating) steel roll is heated to 300-400°F., the printed side being in contact with this roll. The glazed operation simultaneously imparts luster and polymerizes the resin. Surprisingly, no smearing of the printed pattern occurs. The inventor assumes that the retention of some moisture before glazing, combined with a content of lubricating substance in the printing paste, prevents squeezing-out of the print or adherence to the steel roll. In some events it might be necessary to complete curing of the resin condensate by passing the cloth through a curing chamber for 2 min. at 290°F. Instead of urea-formaldehyde resins, other precondensates of thermosetting products (e.g., melamine resins) can be applied. A great number of oils, fats or waxes can be substituted for olein, mentioned as a lubricating agent. The final effect can be characterized as a lustrous, glazed print withstanding water and washing and being practically permanent.

An important feature of the invention is in the production of colored lustrous patterns of the same type. It is suggested that in this event dyestuff combinations of the Naphthol-AS type (AS, AS-RL, AS-OL, AS-SW and so on) be used. Here the naphthol solutions are incorporated in the size before printing and the resin printing paste contains a suitable diazotized salt such as Fast Red Salt RL. In printing and glazing with dyestuff groups other than the insoluble azo dyes, marking-off caused by the hot steel roll would be unavoidable. In applying the diazotized salt paste, however, part of the components not coupled are immediately decomposed by the heat of the roller and no longer able to stain the nonprinted parts by coupling with the naphtholated size.

References cited by the Patent Office, among others:

U. S. Pat. 2,369,613/1945 (Schubert): dyeing and impregnating at the same time by applying an acid dyestuff, urea-formaldehyde precondensate plus sodium sulfate, squeezing and curing.

U. S. Pat. 2,185,746/1940 (Arnold Print Works): glazed chintz effects obtained by first preparing with a removable finish in order to inhibit more than superficial penetration of the resin solution. These are applied in the following step after which calendering takes place to obtain a glossy finish.

U. S. Pat. 2,123,153/1938 (Celanese): local color effects are produced by cross-printing acid dye prints with urea-formaldehyde pastes, curing and fixing the dye only on selected parts. They are also produced by an analogous process for fixing a ciré finish.

U. S. Pat. 2,121,205/1938 (Bancroft): preparing sized raw cloth with formaldehyde-urea, curing and sensitizing one side to obtain blue print cloth ("photovellum") and the like.

Other reference:

U. S. Pat. 2,103,293 (Bancroft): production of chintz effects by combining resin finishes with albumen preparations to prevent crystal formation in the cloth.

Dyeing Vinylchloride Fibers, Basic Dyes Used C, 4, 0 7

U. S. Pat. 2,489,537
(Neumann, Arpin, Nov. 29, 1949)

The present invention is an attempt to solve the problem of dyeing polyvinylchloride fibers. This term includes vinyldichloride — (i.e., vinylidene chloride)— fibers of the "Velan" type as well as copolymers of vinylacetate-chloride. The specification states that attempts at incorporating dyestuff pigments in the spinning mass have failed up to now because of the small selection of shades available, while dyeing of the finished threads has resulted in insufficient penetration and weakening of the material in a prolongated treatment. In contrast, this patent describes the use of dyes which are characterized by transformation into a colorless ("leuco") stage upon alkalization and boiling. Thus it can be seen that only some basic dyes undergo this reaction and that the "leuco products" obtained cannot be confounded with such products, generally termed as leuco dyes and prepared by reducing vat or sulfur dyes. Dyes suitable for the present process are, for instance, Crystal Violet, Methyl Violet, Fuchsine, Malachite Green, Auramine and some other basic dyes. After the dye is dissolved (optionally by applying a solubilizing, water-miscible agent such as alcohol) the solution is adjusted to pH above 10, preferably 10-12. An oxydizing agent—e.g., potassium dichromate or sodium chlorate—is added to this solution which has to be heated to the boil until complete decoloration occurs (Chrysoidine cannot be transformed into absolute colorless solution this way but it becomes very pale). Vinyl fibers are immersed in the colorless solution and the leuco compound is immediately taken up by the fiber and transformed into the original dyestuff compound, probably by salt formation. Dyeing is best carried out at 80-100°C. The higher the temperature, the faster the dyestuff appears on the fiber in its original shade. In case of fading or crocking of the dyed fiber a setting process consisting of a short aftertreatment by heating to 80-100°C. is recommended.

References cited by the Patent Office, among others:

U. S. Pat. 2,232,460/1941 (American Cyanamid): dyeing of fabrics composed of polyvinylhalide-acetate copolymer filaments mixed with cellulose fibers. Dyeing is carried out in a dyebath at temperatures where considerable shrinkage of the vinyl polymers occurs.

U. S. Pat. 2,257,076/1941 (American Cyanamid): dyeing vat (indigo) or sulfur dyes with reduced compounds using as alkaline agent an amine (ethylene diamine).

The reaction protected by the present patent is probably based on the transformation of some basic dyes, particularly of the arylmethane or ketoneimine group into colorless OH (carbinole) compounds by oxidation in absence of acid reagents (cf. "Textbook of Dye Chemistry" by Georgiewics and Grandmougin 1920, p. 174; Moehlau "Organische Farbstoffe" 1890, p. 136, etc.). Industrial application of this reaction has been reported by Nietzki ("Chemistry of the Organic Dyestuffs" 1892, 103) insofar as colorless carbinol bases can be dyed on animal fibers, producing the original shade of the dye by linking to acid groups of the wool molecule. It is quite probable that in the pres-

ent case acid groups likewise present in vinyl chloride fibers are responsible for transforming the colorless carbinol-derivatives into the colored, salt-type products.

Slipproofing Textiles, Alkylated Methylolmelamines in Aqueous Solutions G, 1

U. S. Pat. 2,491,454
(American Cyanamid, Nute, Dec. 13, 1949)

Slippage of fabrics composed of hard synthetic fibers is quite generally a serious problem. Great difficulties have been experienced, particularly during wartime, in preparing and using marquisette screen nettings and screen cloth where warp threads slip over the filling threads as a result of pulling or rubbing the fabrics. This drawback is more noticeable in the use of nylon stockings. It has been found that this trouble can be avoided by impregnating these fabrics with solutions of water-soluble alkylated methylol melamines obtainable according to standard methods by etherifying methylolmelamines under carefully controlled conditions with lower alcohols, (e.g.-methanol, ethanol, ethylene glycol, or diethylene glycol). These lower ethers can be applied more easily than the water-insoluble ethers prepared with higher alcohols; furthermore they proved more efficient in preventing slippage. Fabrics impregnated with 3% of these resins (based on the fabrics weight) are substantially improved with respect to their resistance to slippage. The best effect can be attained with 6-10%. Generally a catalyst (0.35% diammoniumphosphate) is added and curing is effected at 300°F. during 3-5 minutes. A special feature of this invention is the addition of certain pigment colors (Calcophyl Ecru, Calcophyl O.D. No. 3) in order to carry out finishing and coloring at the same time.

References cited by the Patent Office, among others:

U. S. Pat. 2,370,362/1945 (American Cyanamid): textiles finishes obtained by using modified alkyd resins + melamine resins, emulsified with caseinates.

U. S. Pat. 2,343,093/1944 (Du Pont): blending of vinylidene finishes containing an ester gum with a quaternary ammonium compound for promoting adsorption.

U. S. Pat. 2,343,089/1944 (Du Pont): mixing of textile finishes composed of dispersions of polymerized vinylidene compounds with a protective agent such as alkyl cellulose or a product of the Peregal type.

U. S. Pat. 2,340,358/1944 (U. S. Rubber): coating with insoluble macromolecular particles of latex-like resin agglomerates plus protective agents to prevent complete coagulation.

U. S. Pat. 2,329,622/1943 (Cyanamid): use of melamine-formaldehyde condensates cured at 200-300°F., as shrinkproofing agents.

Other reference:

U. S. Pat. 2,050,156 (Aspinook Company: slipproofing of fabrics effected by application of urea formaldehyde, catalyzed with tartaric acid, phenol formaldehyde, catalyzed with ammonia or, generally, with water soluble resin precondensates.

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Desizing Agents—

(Concluded from Page 189)

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Chemical Changes—

(Concluded from Page 180)

weight per square yard, thickness, breaking strength as determined by the strip method, and percentage of elongation under stress. Apparently, as this type of fabric diminishes in thickness and weight due to wear, it not only loses its ability to withstand breaking forces and to elongate, but also loses nitrogen and becomes more susceptible to solution in dilute alkali. As breaking strength measurements on fabrics exposed to light had demonstrated greater losses in the 12-ounce fabric than in the 14- or 16-ounce serges, so a marked increase in the alkali solubility of the 12-ounce serge was observed after 4500 hours of wear with dry cleaning. Probably a heavier, more closely woven fabric would provide for its component fibers greater protection against the effects of sunlight and oxidation than a fabric as thin and light in weight as the 12-ounce serge.

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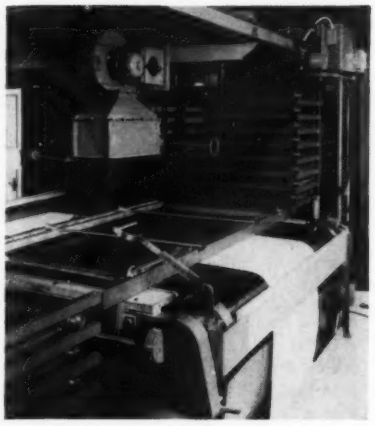
TRADE NOTES • NEW PRODUCTS



Front View of "Teximpex" Screen Printer

• Continuous Screen Printing Machine

U. S. A. International Company, 527 Fifth Avenue, New York 17, N. Y. has announced the installation of the "Teximpex" mechanical screen printing machine at a Haverstraw, N. Y. plant for demonstration purposes.

The machine, which has been reviewed briefly in a Swedish trade journal, is provided with facilities for continuous cleaning of its endless rubber printing mat and continuous pasting of the cloth to the mat during the printing process. The screens are situated in battery-style on both sides of the table. These are operated automatically. The only manual operation is that of the squeegee used in doctoring the print paste.

In the printing operation the endless rubber mat to which the cloth is pasted moves forward the length of one chain rapport, i.e.—the length of the stencil, and the cloth runs into a drying box connected to the table.

The company states that designs 59" x 59" can be printed on the machine and that it will handle up to sixteen colors. "Teximpex" is said to require only 21' x 21' floor space including its dry box. The box is reported to make possible the printing of vat colors and discharge patterns in the conventional manner, whereby there is a full four hour period to get the goods into the ager. It is also reported possible to print pigment dyes and cure them in the box.

Inasmuch as the machine is fully automatic, it is stated that one man will be able to print the same yardage in eight hours as several men would be able to do on tables.

Other advantages claimed for the machine are its quick set-up time, its low maintenance cost, its ability to print over the edges, to print vertical stripes, and to print vinyl plastic. It is further stated that skilled labor is not required to operate the "Teximpex".

Mills in several foreign countries have been in production with the machine for the past year; some of them operating as many as six machines, it is stated.

• "Ambertex M" Vat Thickener

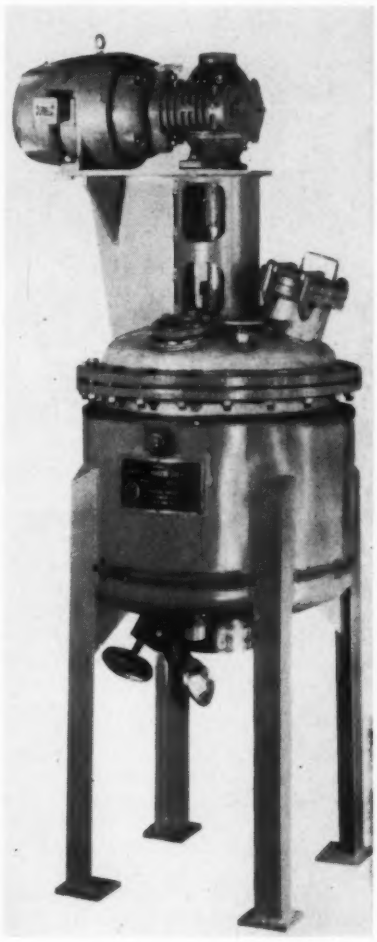
A specially developed vat thickener, produced by National Starch Products, Inc., 268 Madison Ave., New York 16, N. Y., is said to be producing excellent results on French crepes and Bemberg sheers by depositing a soft, pliable film on the cloth, eliminating "splitting" and thereby overcoming the tendency of ordinary thickeners to embrittle, crack or rupture these fabrics. Known commercially as Ambertex M, it reportedly penetrates the cloth, insures a complete discharge of the ground color and prints with unmottled, sunbright brilliance. It also is said to have a cohesive action that not only holds the pattern to the proportions of the original engraving but also reproduces the pattern with sharp detail.

Ambertex M is reported to be less expensive to prepare than conventional cook-up thickeners. With it, vat pastes can be readied in 30 minutes instead of the usual three to four hours, it is stated. Ambertex M is simply blended with vat chemicals and tap water. Further details can be had from the manufacturer.

• Dr. Cofrancesco Joins General Aniline

Dr. Anthony J. Cofrancesco, a resident of North Haven, Connecticut, recently became associated with the Rensselaer plant of General Aniline & Film Corporation as a Process Development chemist. Prior to joining the staff at General Aniline, he was associated with the Calco Chemical Company from 1939 to 1944; Group leader in the vat production unit of Arnold Hofmann Company; Assistant to technical director and later chief chemist at the Garwin Chemical Company.

A graduate of Wesleyan University where he received his B.A. and M.A., Dr. Cofrancesco went on to receive his Ph.D. at Yale University. He is a member of the American Chemical Society and Sigma Xi.



IPE Vacuum Pan Drier

• Vacuum Pan Drier

Industrial Process Engineers, 8 Lister Avenue, Newark, N. J., engineers, designers, and manufacturers of process plants and equipment, has designed and constructed a new "Standard-Plus" vacuum pan drier for the recovery of dry solids by the evaporation of solutions or slurries. The typical unit illustrated reportedly has a working capacity of 35 gallons, and is designed for a jacket working pressure of 50 psi. All parts of the unit in contact with the contents of the vessel are of stainless steel type 316. The agitator, which has no internal bearing, consists of an anchor with spring-loaded scrapers driven at 40 RPM by a 2 HP right-angle gearmotor. In addition to the charge port and nozzles, sight and light glasses are installed in the top head; and a special flush-type plug valve permits free discharge of the product.

Ralph C. Persons

• Persons Elected Director and V-P at Sun Chemical

At a meeting of the Board of Directors of Sun Chemical Corporation, Ralph C. Persons was elected a director and vice-president of the corporation.

Mr. Persons, who has been with the corporation since May, 1944, has served as sales manager of Geo. H. Morrill Co. Division and general manager of Eagle Printing Ink Company Division. In July, 1946, Mr. Persons became general manager of the Geo. H. Morrill Co. Division. He will continue in this capacity and also be in charge of Sun's Graphic Arts Group.

• Kennedy Appointed LTI Wool Head

James H. Kennedy, Jr., formerly Assistant Professor in the Woolen and Worsted Department of the Lowell Textile Institute, Lowell, Massachusetts, has been appointed by the Board of Trustees to head the department, according to a recent announcement by the Institute's President, Kenneth R. Fox. Professor Kennedy's appointment fills the position made vacant by the death of Professor Russell L. Brown.

Professor Kennedy lives in Chelmsford, Massachusetts and is a graduate of the Institute. He joined the teaching staff in 1925, having had several years experience in the general textile field and ten years association with the Arlington Mills, Lawrence, Massachusetts. He is a member of Tau Epsilon Sigma, honorary textile fraternity, and is in charge of the Area Quartermaster's Unit Reserve.

Also appointed to the Institute's staff by the Trustees was J. Frederic Burtt of Lowell, who replaces Associate Professor John C. Lowe of Dracut, Massachusetts, who has retired. Mr. Burtt was named Assistant Professor in the Woolen and Worsted Department.

Professor Burtt was graduated from Lowell Textile in 1931 and attended Boston University and Massachusetts Institute of Technology. He is a former Supervisor of Spinning, Twisting and Knitting at the Abbott Worsted Company's Lowell plant.

• Grayson Joins Paulden

Paulden Laboratories, Inc., Carlstadt, N. J., has announced that Maurice Grayson is now associated with their firm of textile processing consultants.

Mr. Grayson was formerly with Hart Products Corporation. Prior to that, for a period of fifteen years he was associated with the United Textile Print Works, E. & W. Dyeing & Finishing Co., Pilgrim Piece Dye Works and Newburgh Finishing Co., as supervisor of finishing operations.

Mr. Grayson has been instrumental in introducing several improvements in the technique of dyeing and finishing cloth particularly in regard to the proper preparation of cloth for subsequent processing. At present he is devoting his efforts at Paulden Laboratories to determine the most efficient methods of dyeing and finishing nylon goods.

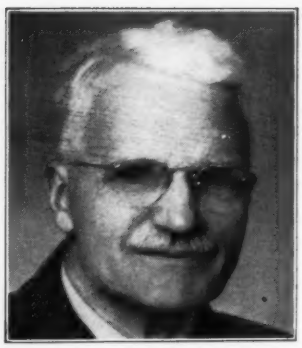
Maurice Grayson

• H. W. Martin Retires

H. W. Martin, a pioneer in the American Dyestuff Industry, recently retired at General Dyestuff Corporation after 49 years with the company, most recently as secretary.

Mr. Martin was born in 1878 in Bingley in the Textile district of Yorkshire, England. He was educated at the Board School and Grammar School (founded 1529) whence he won a Scholarship to Yorkshire College (now the University of Leeds). After several months at dyestuff plants in Elberfeld and Frankfurt a/M he was employed as chemist at cotton warp and skein dyehouses in Bradford, and Oberlangenbielau, Germany. His connection with Kuttroff, Pickhardt & Co. Inc., began in 1901 when he went to Ludwigshafen to become familiar with the products of Badische Anilin & Soda Fabrik. He then came to New York in June 1901 and specialized in the application of Kryogene (Sulfur) Black.

On January 20, 1902, he dyed 100 l's. mercerized yarn with Indanthrene S for the first time in the U. S. A., using as a vatting agent a mixture of zinc dust and sodium bisulfite, hydrosulfite not being



H. W. Martin

available until several years later. In January, 1906, he was transferred from New York to the Philadelphia branch of Continental Color & Chemical Company. When this was broken up in September, 1907, he joined the Badische Company as Salesman and Demonstrator. As such he was active in 1910 introducing combinations of direct and acid colors to produce fashion shades on silk and mercerized hosiery, a new development of that period.

During World War I he summarized and reviewed Norton's Dyestuff Census of the U.S.A. for the September 1917 issue of the *Journal of the Society of Dyers and Colourists* under the title, "The United States as a Dyestuff Market." On November 1, 1917, Badische Company was succeeded by Kuttroff, Pickhardt & Co. Inc.

On December 4, 1922, he succeeded E. K. Halbach as Manager in Philadelphia.

When Kuttroff, Pickhardt & Co. Inc. joined General Dyestuff Corporation, January 1, 1926, he became Manager of its Philadelphia branch. On July 1, 1927, he was transferred to New York to become a member of the Executive Group. On May 6, 1929, he was elected Secretary of the corporation and served in this capacity until he retired December 31, 1949, after nearly 49 years of continuous service with General Dyestuff Corporation and its predecessors. He was also a Director from March 25, 1936, until July 13, 1942, and Vice-President of its 25 Year Club in 1949.

• Heads New Marine Division

Frank E. Firth has recently become associated with The Wilbur & Williams Company of Boston as Manager of the Marine Sales and Engineering Division.

The Wilber & Williams Company will extend the work Mr. Firth has been conducting on technical problems confronting the commercial fisheries as well as the Marine industry in general, particularly those related to vessel and equipment maintenance and specializing on corrosion resistant, rust inhibitive and flame retarding coatings.

• Chlorine Reference Book

Basic data covering the safe storage, handling and use of chlorine, as well as its physical properties, are presented in a new "Chlorine Handbook" available from the Diamond Alkali Company, 300 Union Commerce Bldg., Cleveland 14, Ohio.

The booklet describes and illustrates three approved, standard-size cylindrical containers used to package Diamond liquid chlorine for rail and truck shipment; gives "how-to-do-it" data on proper chlorine service tools, equipment and accessories; shows typical installations; and presents similarly helpful information on first aid measures, gas masks and emergencies. History and growth of the chlorine industry, including Diamond's contributions to its development, are also outlined.

The second section of the handbook is devoted to a review of the major physical properties of chlorine. Supplementing the discussion are eight charts and tables covering its enthalpy, vapor pressure, density, specific volume, solubility and viscosity. The enthalpy—temperature diagram for liquid chlorine is said to represent the first one presenting comprehensive data of this type.

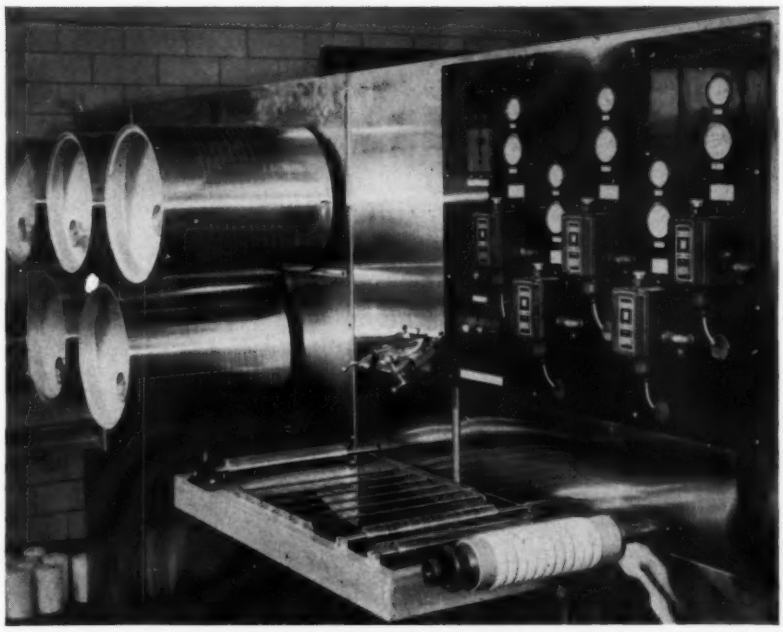
• Burlington Gift to PTI

The Burlington Foundation, a trust established by Burlington Mills Corporation, has contributed a gift of $52,500 in the interest of textile education to the Philadelphia Textile Institute Foundation, it was made known yesterday by Colonel Millard D. Brown, President of the P.T.I. Foundation. One of the three power weaving rooms in the Institute's new building in Germantown will be named the Burlington Mills Weaving Laboratory and will be devoted to educational instruction in the weaving of synthetic fabrics.

Robert L. Huffines, Jr., President of Burlington Mills Corporation (N. Y.) presented the gift in behalf of the Burlington Foundation. Mr. Huffines is a graduate of Philadelphia Textile Institute, class of 1926, and a trustee of the Foundation.

• Experimental Slasher Tests Synthetic Sizing Agents

A complete, experimental slasher for testing synthetic sizing agents has been announced by Monsanto Chemical Company. The stainless steel unit, part of an improved testing system developed by Monsanto, has been set up in the company's Merrimac Division textile laboratories at Everett, Mass. and is reported to reproduce as closely as possible the model's counterpart in the mill. It is designed to afford great latitude in control of normal variables.



Monsanto Experimental Slasher

The slasher includes a removable size box, immersion roll, squeeze rolls, five drying cans, lease rods, rake and take-up beam. Dry cans, rolls and other moving parts are connected through a stainless steel panel with the operating mechanism. Metal locker doors in the rear of the unit provide access to the parts.

Thermostatic controls are said to maintain size temperatures and the size box at between 90 and 220 degrees F. The immersion roll and bottom squeeze rolls are stainless steel. The upper squeeze roll is rubber covered. Gauges are attached for reading the variable air pressure.

Individual controls run to each of the five drying cans. Gauges on each can indicate temperature; maximum temperature is 298 degrees F.

Six lease rods separate the yarns. The slasher is reported to have a capacity of 300 yards at a speed of zero to 15 yards a minute with a stretch up to 20 per cent.

Runs on the slasher are preceded by tests of tensile strength, elongation, hardness, flaxibility or fold endurance, and moisture regained. Aqueous solutions are prepared for this purpose.

Synthetic sizings that meet these tests favorably are approved for further trial on the experimental slasher. Sized yarns treated with the tested material are examined for tensile strength, elongation and size content, and microscopically in cross section to assess penetration. Abrasion tests are run on a cohesion tester, single end yarn abrader and the dynamic heddle abrasion tester.

Milton J. Scott, assistant director of research at Merrimac stated that the design and construction of the new experimental slasher is one step toward an improved system of testing whether a synthetic resin has any value as a warp size. "The new slasher has a major role among preliminary screening aids, as well as in technical service to mills using Stymer S, Monsanto's chemical aid for sizing acetate warps."

• Col. Gage to Manage Trade Fair

Col. John N. Gage, commanding officer of the U. S. Army Quartermaster Depot in Chicago, was named managing director of the First United States International Trade Fair to be held in Chicago, August 7 to 19, 1950, in a recent announcement by I. S. Anoff, president of the nonprofit corporation sponsoring the Fair.

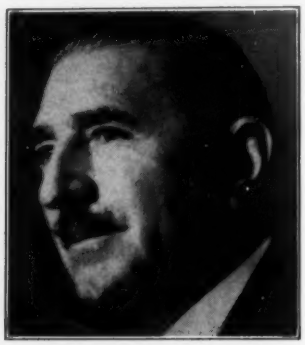
• Barnstead Catalog

Barnstead Still & Sterilizer Co., Inc., 148 Lanesville Terrace, Forest Hills, Boston 31, Mass., has issued a new catalog which describes the difference between distilled and demineralized water. This 20-page illustrated catalog highlights the advantages of either distilled or demineralized water as used in manufacturing and processing operations which call for pure water. It answers the question "What is the difference between distilled and demineralized water?" and also cites case histories on quality control of water as well as showing how ion-exchange purification works.

Write Barnstead Still & Sterilizer Co. for Catalog 123.

• 21st TRI Meeting Plans

Floyd W. Jefferson, President of Iselin-Jefferson Co., cotton goods merchants of New York, will climax two days of scientific papers and progress reports at the 21st Annual meeting of the Textile Research Institute, Inc., to be held at the Waldorf-Astoria Hotel, New York City next November 16th and 17th it was announced by A. G. Ashcroft, Institute President.



Floyd W. Jefferson

The first day will be devoted to scientific papers. The program November 17th will deal with reports on the theme "Textiles on the March" and will conclude with a luncheon at which Mr. Jefferson will address the gathering.

Mr. Ashcroft also announced his appointment of the 21st Annual Meeting Committee: Ephraim Freedman, Chairman, Director, Macy's Bureau of Standards; Dr. J. H. Dillon, Institute Director of Research; J. S. Jacobs, Institute Publications Director; T. G. Hawley, Jr., Director of Research, United Merchants Laboratories, Inc.; D. B. MacMaster, Institute Secretary; C. H. Masland II, C. H. Masland & Sons; and Dr. D. H. Powers, Director of Research, Wm. R. Warner Co., Inc.

Ephraim Freedman

"Conscious of the increasing industry-wide prestige of the Institute", Mr. Freedman stated, "my committee has completed its plans and are engaged in implementing arrangements necessary to development of a most ambitious program to make the attendance at the 21st Institute Annual Meeting a must for all leaders in the textile industry. "The program", he added, "will highlight the march of textiles during the first half of the 20th century and its impact upon the world, the nation, and the textile industry itself."

• Progress Noted by PTI Board of Governors

The quarterly meeting of the Board of Governors of the Philadelphia Textile Institute was marked by reports of progress in the school at its new home.

The board met to reorganize under the new Philadelphia Textile Institute Corporation. Acting Chairman Rinaldo A. Lukens is president of the corporation, and serving as vice-chairman is Theodore B. Hayward, chairman of the Board of Trustees and of the Executive Committee. Representing the Foundation of the Philadelphia Textile Institute on the Board of Governors is Colonel Millard D. Brown. Other members of the Board present were James M. Cole, Howard P. Galloway, Gerome Leonard, F. Everett Nutter, Russell C. Osborne, H. Wickliffe Rose, Edgar L. Schlesinger, Robert A. Smith, and Frank Zurn.

Secretary-Treasurer of the corporation Julius Zieget; his assistant, Anthony J. Haldis; Director Bertrand W. Hayward and Dean Richard S. Cox completed the roll call.

Two resolutions of appreciation were voted; one to the Foundation for its efforts in securing the new physical plant, including the grounds, administration building, classroom building and the Hesslein Library Building; the second to the faculty and staff for their help which resulted in the completion of the moving and organization which permitted classes to resume in the Fall with a minimum of delay and interruption.

Director Hayward reported on his trip to Europe to survey the centers of textile training there. Dean Cox, in his report on the student body, noted that adequate housing had been obtained for the students and the progress reports on student work were favorable.

In the report from the equipment committee, Robert Smith included articles obtained and put into operation in each department in addition to those considered as a part of the building.

Future plans to continue improvement of the school were the items of new business.

• Leitz Industrial Rouy-Photrometer

Tests and performance in the field have demonstrated possibilities in routine processing analyses for the Leitz Industrial Rouy-Photrometer, E. Leitz, Inc., New York. The instrument's use in food industries indicated its potential value in fields which need a precise and accurate method of measuring color variations.

Leitz Rouy-Photrometer

Designed to speed routine processing analyses, the new Industrial Rouy-Photrometer is said to provide the highest accuracy obtainable in colorimetric absorption analysis. This photoelectric colorimeter reportedly gives concentration readings in which inherent functional error is cut to within 0.1%. Such a high degree of accuracy is reported possible for the first time through careful matching of the photoelectric cell and the microammeter, which is said to result in strict linearity of current vs. light energy.

Operation of the Rouy-Photrometer is said to be rapid and simple, with a single control for all adjustments. Once calibrations have been set up, no special skill or calculation is required of the operator, and routine colorimetric analyses can be made, the manufacturer states.

Maximum reproducibility and highest selectivity over the entire visible spectrum are said to be other Photrometer advantages.

The Rouy-Photrometer is a single cell, line-operated instrument. On special order, it is adaptable to 6-volt D.C. operation. It is available with four absorption cells, one sealed H_2O absorption cell, plastic insert, dust cover and handbook.

Harold F. Merritt

• Merritt Named Executive V-P of Solvay Sales

Harold F. Merritt has been appointed Executive Vice President responsible for the direction of all activities of the Solvay Sales Division, Allied Chemical & Dye Corporation.

Mr. Merritt started in 1913 with Wing & Evans, Inc., and, with the exception of two years of Army flying duty during World War I, has served continuously with that company and the Solvay Sales organization which succeeded it. He has been a Vice President of Solvay Sales for the past nineteen years.

• Calco Technical Bulletin

The paper "Vat Dyeing: Importance of Initial Exhaustion Rate," presented by O. W. Clark and H. R. McCleary, American Cyanamid Company, Calco Chemical Division, at the Cellulosic Fibers Group Meeting, A.A.T.C.C. Atlantic City National Convention, has been reprinted as Calco Technical Bulletin No. 810. The paper is concerned with the exhaust behavior of vat dyes on cotton cloth. Accurate data on the exhaust behavior of several vat dyes from the leuco bath are presented and the results of laboratory continuous reduced dyeings are examined in relation to these exhaust data. Copies of Calco Technical Bulletin No. 810 can be obtained by writing Advertising Department, American Cyanamid Company, Calco Chemical Division, Bound Brook, New Jersey.

• Oil Chemists' Spring Meeting

Plans for the spring meeting of the American Oil Chemists' Society in Atlanta, Ga., May 1-3, at the Atlanta Biltmore hotel are progressing, according to E. C. Ainslie, general chairman, and Dan Lee Henry, program chairman. The program will be announced shortly. Sunday afternoon, April 30, has been scheduled for a meeting of the Governing Board by V. C. Mehlenbacher, president.

Plans for the third annual short course of the Society, to be held August 7-11 at the University of Minnesota under the cosponsorship of the Society and the Federation of Paint and Varnish Production Clubs, are also progressing. The subject will be drying oils, and the Minneapolis committee on arrangements will include S. O. Sorensen, W. H. Goss, and J. E. Kortum. Enrollment will be limited to 100; the fee has been set at $25 for men in industry, $10 for students. Applications are to be sent direct to Fred E. Berger at the university.

An election slate is now being prepared for officers for 1950-51, with voting by mail after March 3 and announcement of results during the May 1-3 meeting in Atlanta. J. R. Mays Jr., Barrow-Agee Laboratories Inc., Memphis, will be the incoming president.

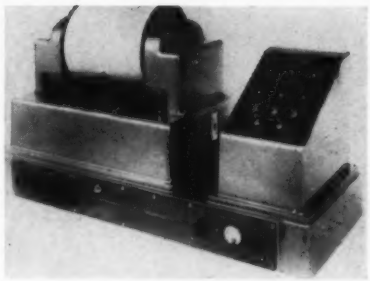
• Cotton Council To Catalogue Research

The National Cotton Council has started the job of cataloguing all cotton research knowledge in line with the recommendation proposed at the Council's Cotton Research Clinic meeting in Washington recently according to Dr. Leonard Smith, Utilization-Research Director.

Dr. Smith stated that the objective would be to make available not only current resarch efforts but also unpublished and possibly obscure information which might be helpful. The Council's Utilization-Research Division is now taking steps to implement the clinic's recommendation.

The Council's research director also announced that a detailed report covering the three-day cotton clinic discussions would be issued at an early date. "A number of new research techniques were suggested and discussed by the conferees," Dr. Smith said. "For example, the Textile Research Institute, Princeton, New Jersey, is using a new method of statistical analysis of research data. This technique, which permits rapid use of significant measurements on a large number of single cotton fibers, gives promise of providing information on qualities of cotton which influence its spinning behavior in mills as well as its performance in end products."

The Clinic heard a suggestion that the fundamental technique of solvent exchange might be adapted to practical finishing operations such as those to provide crease resistance, flame resistance and luster. In the solvent exchange technique, cotton is first swollen with water or another swelling agent which is successively displaced by alcohol or acetone and then by benzene. When the benzene treated fiber is dried, its structure remains open and more receptive to larger molecules of the crease-resisting resins, fire-proofing chemicals or dyestuffs.



Perkin-Elmer Spectrophotometer

• Double Beam Infrared Spectrophotometer

A double beam infrared spectrophotometer said to possess a wider range of operating variables than earlier commercial models is now in production at the plant of The Perkin-Elmer Corporation, Glenbrook, Conn. The new instrument, known as the Model 21, is claimed by the manufacturer to be the first infrared spectrophotometer to meet the demands of the structural chemist for high resolution and sensitivity, and the analytical chemist for speed and accuracy.

The Model 21 records directly in percent transmission against a linear wavelength scale on large charts. The instrument's resolution is said to be up to the limitations imposed by the Raleigh criterion and Johnson noise. Its speed of scanning reportedly ranges from 3 minutes to 100 hours for the rock salt region. The wavelength drive speed can be suppressed automatically when desired. Time of response is claimed to vary from a few seconds to more than a minute for full scale deflections. The over-all range of the instrument is from less than 2 microns to 15 microns in the rock salt region, the company states.

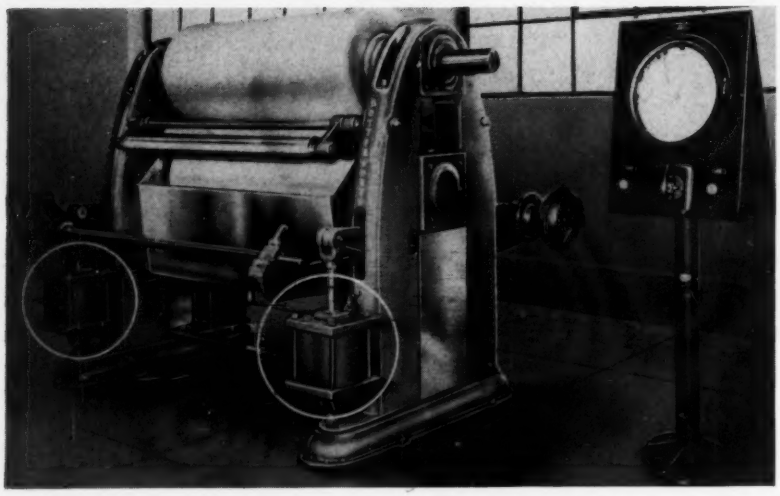
Chart scales of the Perkin-Elmer Model 21 are uniform from 1 to 50 inches per micron by integral factors. The chart size is about 32 inches by eleven inches. The instrument is 40 inches long, 22 inches high, and 20 inches wide. Amplifiers and power supplies are external.

• Staley Sales Appointments

Appointment of two new representatives of the industrial sales division has been announced by A. E. Staley Manufacturing Company, Decatur, Ill., which markets a line of industrial products made from corn and soybean. The men and their territory assignments are:

Paul H. Prentiss of 1608 Courtland Avenue, Park Ridge, Ill., formerly with American Maize Products of New York, will work in Chicago and the Mississippi Valley states as a special sales representative.

Ronald W. Murphy of 1248 34th Avenue, San Francisco, who formerly was in the food brokerage business there, will have the West Coast as his territory.



Miller Air Cylinder on Butterworth "Bullet" Padder

• Air Cylinders Provide "Squeeze"

Air cylinders, adaptable for applying "squeeze" required for the pressure rolls of bullet padders, washers, steamers, rope squeezers, continuous dyeing and other textile machinery and equipment, are now being offered by Miller Motor Company, 4027 North Kedzie Ave., Chicago, Ill., manufacturer of air and hydraulic cylinders. According to the manufacturer, precision-accurate adjustment and repetitive application of pressure to always the exact degree desired are assured by the leakproof operation of the cylinders and the low "break loose" pressures required to obtain smooth piston movement. The company is reported to pre-shipment test all cylinders, which includes a leakproof "water bubble" test and a low friction test in which each cylinder must cycle smoothly at 1 to 5 lbs. air line pressure or less (depending on cylinder size) before passing the Inspection Department.

Other reported features of the cylinders are: hard chrome plated piston rods to resist nicks, scratches and corrosion; dirt wipers at rod ends to wipe rods clean of dirt and lint on every "in" stroke; noncorrosive, rustproof, honed hard brass tubing cylinder barrels; and extra-rugged construction throughout with heads, caps and mountings machined from solid steel bar stock.

The cylinders are offered in a complete line, from 1½" to 20" bores for 200 psi operation or less and in a selection of mounting styles.

For additional information and illustrated bulletin, write Miller Motor Company.

• Glos Heads Analytical Lab.

Arthur F. Glos has been put in charge of the analytical laboratory of the Hilton-Davis Chemical Company Division, James F. Thompson, vice-president of Sterling Drug Inc., and divisional general manager has announced.

Mr. Glos was formerly in charge of pigment research and raw material testing for the pigment department, where he is being replaced by Walter Steele, long associated with that work. In 1935, Mr. Glos became associated with Hilton-Davis as a research chemist. While working in the firm's research laboratories he completed his studies at the University of Cincinnati and was graduated as a chemical engineer in 1941.

• Builders-Providence to Move

Builders-Providence, Inc., Providence, R. I. have announced that they are moving to larger headquarters for "more efficient service to Builders, %Proportioneers%, and Omega customers." After March 15 their address will be 345 Harris Avenue, Providence, R. I. Builders specializes in recording, indicating and controlling instruments.

In the February issue of ADR a photo of the Builders Chlorinizer appeared. The photo was incorrect as it stood, as it was in an inverted position. Gauges and rotameter should appear so as to be at eye level.

• Chemical Corporation Expands

Haas Miller Corporation, Philadelphia, Penna., manufacturers of industrial chemicals, oils and greases, are continuing their expansion program by the erection of an additional modern office building. Last year's program, now completed, included a new and additional manufacturing building, together with the installation of practically all new, high-pressure stainless steel plant equipment.

OBITUARY

FRANK STUTZ

FRANK STUTZ, President of Better Fabrics Testing Bureau, Inc., died of a heart attack on February 18th in Miami, Florida, where he was on vacation. Funeral services were held on February 22nd in New York.

Mr. Stutz was born in Ellerbe Springs, North Carolina on April 17, 1896. He was graduated from Elon College, North Carolina and served in the Army Air Force during the First World War.

In 1925 he became associated with what is now known as the National Institute of Cleaning and Dyeing. He was instrumental in the founding of the Institute's vocational training school at Silver Springs, Maryland.

While associated with the dry cleaning industry, Mr. Stutz became interested in consumer problems traceable to unserviceable textiles. In 1928, with the cooperation of the National Retail Dry Goods Association he founded the Better Fabrics Testing Bureau as the official laboratory of the Association. For the past 20 years, however, it has operated independently. As President of the Bureau for the past 22 years, Mr. Stutz played a large part in many of the notable achievements in the testing field, particularly with regard to test methods and standards of quality. He was an active member of the Association, serving on several of its research committees. In addition, he was a member of the A.S.T.M., the A.A.T.T., the A.A.T.C.C., the Manhattan Club and the Westchester Country Club.

Mr. Stutz is survived by his wife, Louise, a daughter, Mrs. Marshall K. Walker and a son, Robert L. Stutz.

IRVING C. RUHMAN

IRVING C. RUHMAN, Manager of the Arnold Print Works, Adams, Mass., died on February 27th at his home in North Adams after an illness of three weeks. He was 52 years old.

Mr. Ruhman was born in Cambridge, Mass. and graduated from Harvard University in 1920. He started as a chemist with Arnold shortly after graduation and advanced steadily, becoming manager in 1947. He was prominent in Masonic circles and was a member of the American Association of Textile Chemists and Colorists.

Mr. Ruhman is survived by his widow, a son, and a brother.

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For the Textile Bookshelf

Calco Technical Bulletin No. 810—"Vat Dyeing: Importance of Initial Exhaustion Rate" by O. W. Clark and H. R. McCleary. Discusses the exhaustion rate of vat dyes on cotton cloth, with accurate data on behavior of several vat dyes from the leuco bath. It also examines results of laboratory continuous reduced dyeings in relation to these exhaust data.

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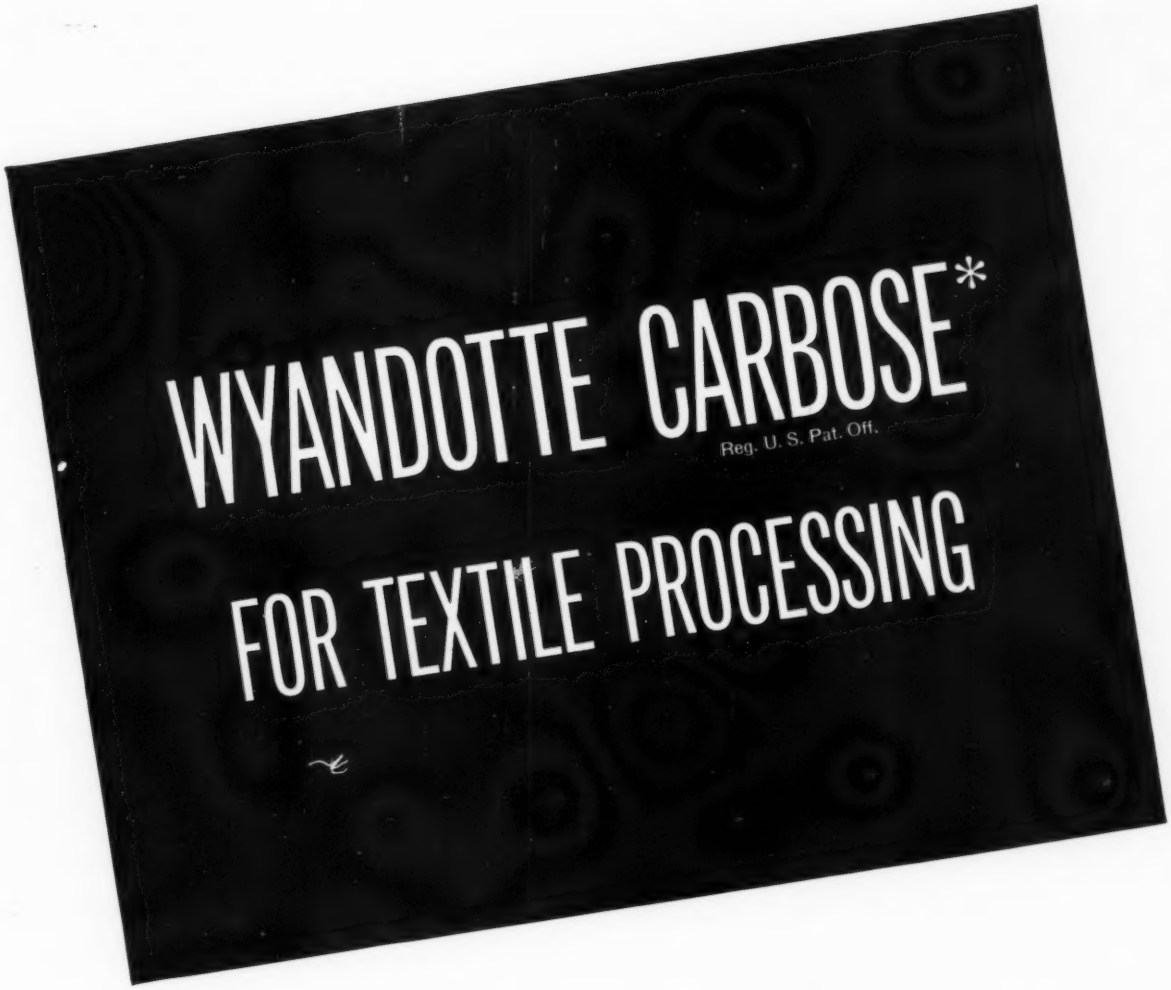

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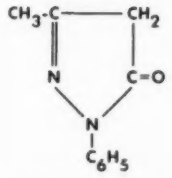

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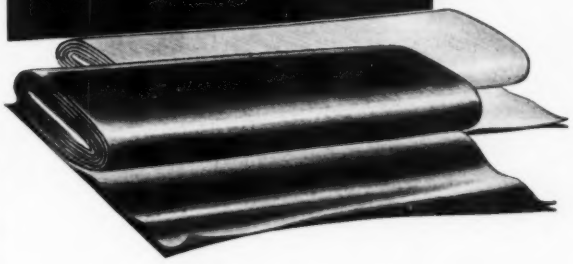

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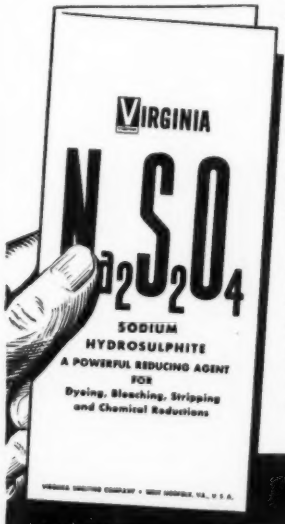

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To give producers of woolens and worsteds a wide selection, Swift & Company offers this full line of special purpose fiber lubricants:

GENERAL INFORMATION

Swift's Wool Oils tend to stay fixed to the wool where they are needed, rather than spreading to card clothing, aprons, etc. In many cases, they give greater lubrication per pound than conventional oils. They are carefully formulated to emulsify readily and come out easily during scouring operations.

All Swift's Oils (except NAWM specification oils) contain a penetrating agent which greatly aids in even wetting of wool by the emulsion.

PRODUCTS

The best recommendation for any of these oils is its performance under your own mill conditions. We suggest you try Swift's Oils to see for yourself if the characteristics described below do not hold true in your operations.

1 **70S—Very economical lubricant for wool fibers.** Formulated to produce loftier yarn. Treated to reduce oxidation. Contains base of high grade sulfonated animal oil to give adequate lubricating properties.

2 **1350S—High efficiency lubricant for wool and synthetic fibers.** 100% glyceride—contains no mineral oil. Intended to save on soap.

3 **350S—Lubricant specially formulated for synthetic fibers.** Ideal for synthetic staple. In testing, note how 350S forms stable emulsions with low percentages of water.

4 **50—For NAWM "Commission Combing."** Blended to the rigid specifications of the National Association of Wool Manufacturers.

5 **100**—Same as No. 50 Wool Oil with good quality red oil and triethanolamine added to promote rapid emulsification.

Swift's Lard Oil available treated to reduce rancidity

Many woolen mills specify pure Lard Oil or Grease Oil for fiber lubrication. Now you can order Swift's Lard Oil with either of two effective anti-oxidants added to retard oxidation, rancidity, gumminess and change of color.

A phone call or postal card will bring full information about any Swift Oil.

Order a trial drum at carload price.

Swift & Company
CHICAGO 9, ILLINOIS

AD 3-20

Please send me, at carload price, a 55 gallon trial drum of Swift's Wool Oil.

☐ 70S ☐ 1350S ☐ 350S ☐ 50 ☐ 100

I understand if not fully satisfied, I may return it for credit at your expense. *This offer expires May 15, 1950.*

*Name*_____ *Title*_____

*Firm Name*_____

*Address*_____
(Street & No.) (City or Town) (Zone) (State)

A NEW RESEARCH MODEL

Launder-Ometer

—accommodates larger samples for more accurate shrinkage testing.

Two new models have been added to the line of Atlas Launder-Ometers that materially expand the range of tests for the determination of resistance to mechanical and washing action, shrinkage and staining, and for proving the color fastness of dyestuffs. All factors can be controlled carefully and reproduced identically at any time.

Both new units incorporate improvements in design and function, and are adaptable to larger size containers for greater general utility. Model L1Q is constructed with a capacity of 20 pint or 20 quart jars; Model L2Q with capacity for 20 pint, 20 quart, or 6 half-gallon containers. The half-gallon size jars make possible the use of larger-sized samples for more accurate testing of shrinkage resistance. Both machines can be supplied with vari-speed drive units for operation at selected speeds between 10 and 50 R.P.M.

Both Models L1Q and L2Q are equipped with the Atlas pre-heating loading table which increases the accuracy of tests by starting all samples at the same temperature.

Atlas-Ometers — Launder-Ometers, Weather-Ometers, Fade-Ometers, the standard accelerated testing machines accepted throughout the world for over a quarter of a century.

ATLAS ELECTRIC DEVICES CO.

361 W. SUPERIOR ST., CHICAGO 10, ILLINOIS

WEATHER-OMETERS • FADE-OMETERS • LAUNDER-OMETERS

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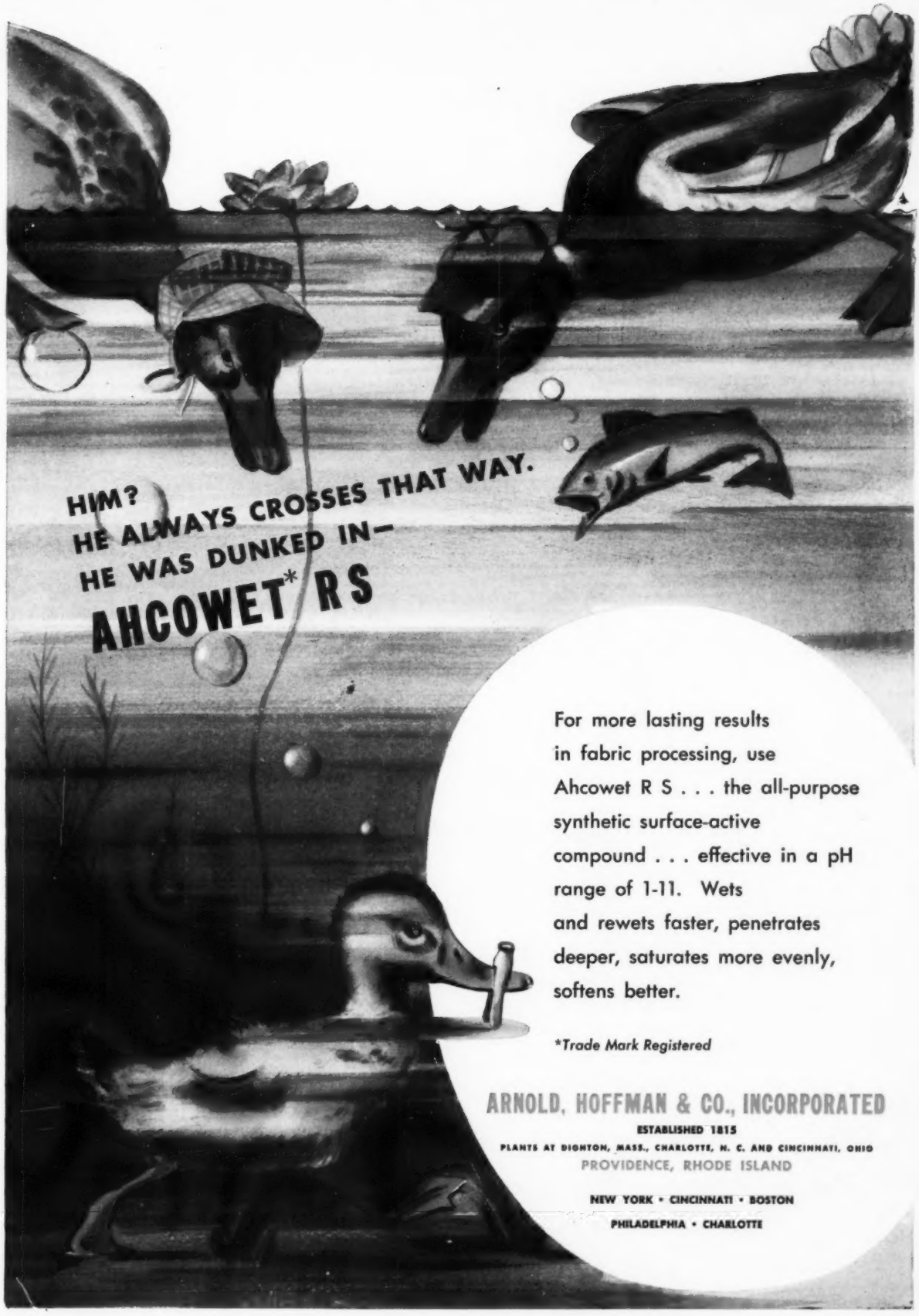

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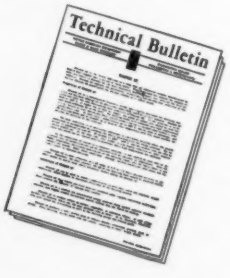

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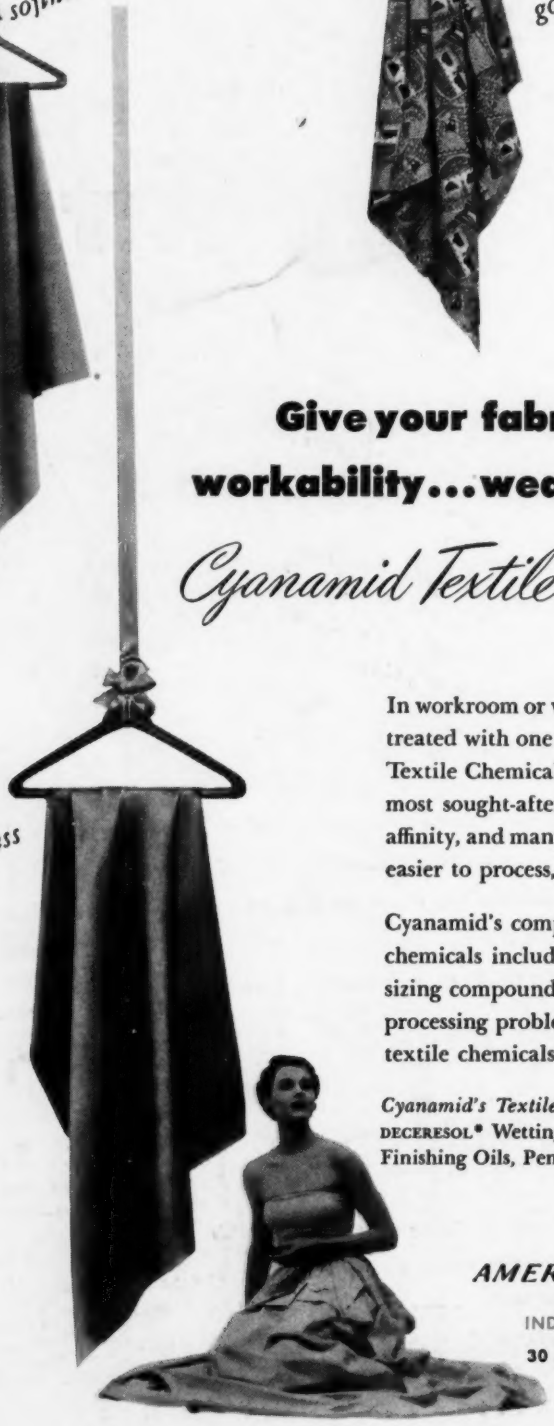

In workroom or wardrobe, fabrics find a ready welcome when treated with one or more of the dependable Cyanamid Textile Chemicals. These are chemicals which impart the most sought-after qualities—suppleness, softness, good dye affinity, and many other characteristics that make fabrics easier to process, to handle, to *sell.*

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